(V)
193

The Indian Forester

Vol. – (IV)

No. – I

July, 1878

Sub. – Forestry Journals

WEST BENGAL SECRETARIAT LIBRARY

Contents.

Page.

I.—Articles, etc.—

Sulpiz Kurz ... ...

Report on the Investigation and Collecting of Plants and Seeds of the India-rubber Trees of Para and Ceara and Balsam of Copaiba, by Robert Cross ... ...

Ficus elastica in Arakan 4

Introduction of Rubber Plants into India ... ...

Timber Trade in Assam, by W. R. F. ... ...

The Forest School at Dehra Doon 53

Memorandum by Dr. Brandis on the Valuation Surveys lately made, and proposed to be made, in some of the Sal and Coniferous Forests of the North-Western Provinces 60

The Budget Estimate of the Forest Department, for 1878-79 65

A Manual of Indian Sylviculture 76

The Catalpa and its Uses 79

II.—Reviews—

The Journal of Forestry and Estates' Management ... 84

Grevillea 90

A Catalogue of the Forest Trees of the United States, etc. 91

III.—Notes and Queries—

Preparation of Bamboo Fibre for Paper-Making, by A. Smythies 94

Pithecolobium Saman 96

Distribution of Timber Specimens 96

A Plea for Sal, by W. R. F. 99

Seed of New Trees from Queensland 101

The Baobab Tree in South Punjab 102

Effect of Mortar on Pine Timber used in Buildings ... 104

Development of the Colours of Wood 104

The Forests of Cyprus 105

Species of Prosopis 106

Monsieur Bert's Visit to India 108

IV.—Extracts from Official Gazettes 109

Errata—

X

THE

INDIAN FORESTER.

Vol. IV.] JULY, 1878. [No. 1.

Sulpiz Kurz.

Mr. S. Kurz, late Curator of the Herbarium at the Botanical Gardens, Calcutta, and one of our most valued contributors, succumbed to the effects of a tropical climate at Penang on the 15th January 1878. We feel sure the following sketch of his life, read by Dr. D. Brandis at the Meeting of the Asiatic Society of Bengal, will interest our readers :—

Sulpiz Kurz, Curator of the Herbarium at the Botanic Gardens, Calcutta, was born at Augsburg, in Bavaria, on the 5th May 1834. His father died early, and the boy attended school at Munich, where his mother had settled. At an early age he commenced collecting objects of natural history, especially insects. After leaving school he attended lectures at the University of Munich, and chiefly devoted himself to the study of Botany, Mineralogy aud Chemistry. In 1854 misfortunes in his family compelled him to abandon his studies, and he went to Holland where he worked as an apothecary, and, after mastering the Dutch language, enlisted in the Subordinate Medical Service of the Dutch Colonial Army. He landed at Batavia in September 1856, and was sent to Banka in March 1857, where he remained two years. During that time his work was light, and he was able to explore the island and to make botanical collections. In 1859 he was re-called to Batavia and joined the Military Expedition to Bori in Celebes. In September 1859 Kurz returned to Batavia, and was appointed as an Assistant on the Staff of the Botanic Garden at Buytenzoorg. Here, for the first time in his life, he had the advantage of working under the guidance of other botanists, and with the assistance of a large library and a rich herbarium,

he devoted himself principally to Ferns, Bamboos, Musaceæ, Pandaneæ and other difficult groups. A few years later Dr. Thomas Anderson, the Superintendent of the Botanical Gardens, Calcutta, came to Java in order to study the system of Cinchona cultivation which had then for some time been established by the Dutch authorities. He induced Kurz, with the permission of the Dutch Government, to accept the appointment, which he held at the Herbarium of the Calcutta Botanical Gardens until his death. In October 1863 Kurz left Java, and joined his new appointment at the Gardens early in 1864.

Before his transfer to Calcutta he had not published much; a few papers only on the vegetation of Banka and other matters had been printed in the "*Naturkundige Tydschrift voor Nederlandsch Indie.*" In Calcutta, however, he commenced a series of important botanical publications, which appeared in English and Continental Periodicals, chiefly in the London Journal of Botany, the Proceedings of the Linnean Society, in Miquel's Annales, the Flora of Regensburg and the Botanische Zeitung. But his later and most important papers were published in the Journal of the Asiatic Society, of which he became a member in 1869.

In 1866, Kurz was deputed by the Government of India to Port Blair, in order to study the vegetation of the Andaman Islands. He spent the months of April and May on that duty, and the results of his explorations were recorded in a most valuable Report which was published by Government in 1870. While engaged in examining the interior of South Andaman, he was seized by the Burman convicts, whom the Superintendent of Port Blair had given to assist him in his work, and was left tied hand and foot in the jungles on the ground. These and subsequent circumstances, which prevented the more extensive excursions which he had projected through the islands, obliged Kurz to return to Calcutta sooner than he had intended.

In 1867, the Government of India decided to employ him on the preparation of a hand-book, intended chiefly for the use of forest officers, of the trees, shrubs and climbers grow-

ing in the forests of British Burma. To this new task, Kurz devoted himself with his usual ardour and enthusiasm, and his researches regarding the Flora of Burma may justly be regarded as the most important work of his life. From December 1867 to June 1868, Kurz explored the forests in the province of Pegu and part of those in Martaban. But when after his return to Calcutta he examined and arranged the rich materials collected by him, he found that many doubtful points remained, and he was accordingly deputed on a second tour to the same districts, which lasted from December 1870 until May 1871.

Besides the materials collected by himself, Kurz had the advantage of consulting large collections made by others in Burma, and he was thus enabled to describe numerous new genera and species. A number of Burmese plants collected by him are described by other Botanists, and deservedly bear his name. Between 1872 and 1877 he contributed two series of valuable papers to the Journal of the Asiatic Society. One series he called "New Burmese Plants," and the other, "Contributions towards the knowledge of the Burmese Flora." A general account of his researches was embodied in a quarto volume published by Government in 1875, under the title "Preliminary Report on the Forest and other Vegetation of Pegu." This work contains an admirable account of the vegetation in all parts of that province, as well as a most useful list of vernacular (Burmese) names of plants with their systematic names.

The chief results of his labours in regard to the Burma Flora, however, were embodied in his Forest Flora of British Burma—a work, regarding which it is not too much to say, that it has placed the name of Kurz in the first rank of Indian Botanists. This work was published towards the close of last year in two volumes, by order of the Government of India. It contains full and clear descriptions of 2,000 species, and will, for a long time to come, remain a standard work of reference for all interested in the vegetation of British Burma and the adjacent countries.

In 1875, Kurz took three months' leave, and devoted it to a botanical exploration of the Nicobars, but exposure and fatigue in the unhealthy climate of those islands brought on a severe attack of fever which much weakened his constitution. In 1876, he contributed to the Journal of the Asiatic Society a paper on the Vegetation of the Nicobars, based chiefly upon the collections made by the Austrian Naturalists, attached to the Novara Expedition. These collections had been sent to him for publication by the Director of the Imperial Museum at Vienna.

On the 12th November 1877, shortly after his Forest Flora had been published, Kurz left Calcutta on leave to visit the Straits Settlements. He reached Penang on the 12th December, but was taken ill and died at that place on the 15th January 1878, at the age of 43 years. An uninterrupted residence in the tropics of 21 years, and constant exposure on his botanical explorations, had undermined his constitution. His ardour in the pursuit of Botany was irrepressible, and he rarely thought of health or comfort on his expeditions.

He was Member of several learned Societies; his fellow Botanists in England, the Continent of Europe and in India will mourn his loss, and by many of his friends outside the circle of those interested in science, he will long be remembered by his enthusiastic and single-minded devotion to the science, which, from early youth, was the aim and object of his life.

Report on the Investigation and Collecting of Plants and Seeds of the India-rubber Trees of Para and Ceara and Balsam of Copaiba.

By ROBERT CROSS.

To the Under-Secretary of State for India.

Grove Street, Edinburgh, 29th March 1877.

Sir,

Respecting the service on which I have recently been employed in the collecting of plants yielding the Para India-rubber of commerce, I now take the liberty to forward a detailed account of my proceedings.

On the 19th of June 1876 I left Liverpool by the "Red Cross" Steamer "Cearense," which, after calling at Havre and Lisbon, sailed direct for Para, which was reached on the 15th of July. This city is situated on the southern bank of the River Amazon, which, at the point where it debouches to the sea, has a breadth of 33 miles. Para is distant 80 miles from the ocean.

The population, numbering about 40,000, are chiefly engaged with the despatch of import and export produce. Everything is very dear, and notwithstanding the reputed fertility of the Amazon valley, I found that nearly all the necessaries of life are imported. Thus, butter and fish come from Norway, rice and flour from the United States, while sugar, coffee, and *mandiocca* are brought from the southern ports of Brazil. Import duties are high, and so also are those on produce exported, amounting in some things, such as rubber, to 25 per cent. of the value of the article. The houses are mostly built of mud and roofed over with tiles. The windows are chiefly formed of wood, hinged at the top, and pushed out from below, whence the inmates, unseen, obtain views of the street and passers-by. Throughout the course of the day many of the occupants are invariably congregated behind these window lids.

The great bulk of the citizens go about more ostentatiously dressed than the people of London, the attire considered essential being fine black coat and hat, with snow-white ironed vest and trousers, and fancy French boots. Those who do not con-

form to this style of dress are stared at. Even at the beginning I did not agree with the fashion, and afterwards was farther removed from it by being almost daily bedaubed over with the mud of the *gapós*. Coloured females and slaves may be seen stepping into carriages perfectly loaded with large necklaces and glittering ornaments, and even the families of foreign residents are frequently dressed in the most excessive and extraordinary manner.

The phase of slavery that exists is in so mild a form that it is at first not observed. In very many instances the slaves are allowed to hire themselves out on condition of paying their owners a certain sum of their daily earnings. The whole system is evidently dying out more rapidly than the Government laws enacted for its abolition require it to do.

Merchandise and other effects are removed from one place to another in the old primitive way, thus employing many hands, who earn high wages. Emigrant Portuguese, of whom there are about 5,000, are mostly the carriers, boatmen, and shop-keepers of the place. The supply of water for the city is carted through the streets in barrels, and sold at the rate of three-halfpence per *poto*. The *poto* contains 21 English imperial pints. Within 12 hours after being deposited, the water is found to precipitate a greenish substance amounting to nearly one-fourth the quantity, which is not removed even if filtered through several folds of stout cloth. In the courtyards of the majority of the houses are open cess-pools, which in such a glowing atmosphere may assist in developing much sickness. Dysentery, yellow fever, and various other forms of a typhoid character appear to be permanent, although of late there have been no serious outbreaks, and the place is reported more healthy than formerly. Tetanus and other forms of nervous affections are of frequent occurrence, especially among the native-born population. I have no doubt that Para is far more unhealthy than any city in India. It may not be so naturally, but by a combination of circumstances; such I believe to be the case.

I found on arrival, after considerable inquiry, that the great field for caoutchouc collecting was the province of Para, and

the islands which are scattered over the lower portion of the Amazon River. Chief of these is the Island of Marajo, which is about the size of Holland. A good deal of the rubber from the Rio Negro, Madeira, and other tributaries, appears to come in the form of "negrohead," or *sernamby*, while the Para region seems to produce to a greater extent the finer kinds of smoked biscuit rubber, the preparation of which is attended to more carefully, besides which the Para tree is reported to be a different variety. Its milk leaves no very prominent stain on the hands or clothing, while the milk of some of the varieties of rubber of the Upper Amazon gives a black ink-like mark to the hands and clothes of collectors. Black rubber is stated by some to be deficient in recoil or elasticity. In order to form and establish a collection of plants, and for the purpose of making the various observations on the soil, climate, and mode of collecting and preparing the rubber, it was necessary to obtain a place to live in while so employed. Everyone told me I would experience great difficulty in finding a dwelling, and this proved true. After travelling round Para, and searching for about eight days, I succeeded in hiring a house, but at a very high rate, as the place was large, and adapted for a family with attendants and slaves. However, it was secure, and offered every facility for my various requirements, which was important. My next work was to examine the district where the rubber trees grew. Mr. Henderson, who was known to Dr. Spruce, kindly introduced me to an old rubber collector, called Don Henrique, who undertook to lead the way to the *seringal*, as the rubber locality is termed, but after disappointing me twice, I resolved to lose no more time, and procuring from him the services of a lad as guide, I commenced to inspect the forest. On the 25th of July I made a preliminary journey to the region where the trees were wrought.

The land around Para, including where the city stands, rises from the banks of the river southward in the form of gentle undulations, indented, however, in many places by deep gully-like natural ditches, called *gapós*, which often penetrate for many miles into the interior of this vast forest region, and are filled daily by diurnal tides. To those navigable by canoes or

sailing craft the term *ajarape* is often applied. The intervening land between the *gapós* is frequently flat and moist, and owes its origin first to tidal deposits, and afterwards is raised higher by the decayed remains of successional rank growths of vegetation. On the elevated lands beds of white sand, 20 feet in depth, are met with, covered with a layer of decayed vegetation. At a similar level to this we find a deposit approaching to clay or very fine sand and mud, with here and there masses of sandstone or granite cropping out. In every direction where a view can be obtained, the country is seen to be covered by dense exuberant forest. Leaving Para, I travelled over the high ground for several miles, until the primitive forest was reached, and then went down towards the *gapós*. Following through the wood, a path used by the caoutchouc collectors, we soon came to a large tree in a state of decay, which had been tapped many times. At first sight I felt extremely puzzled and perplexed at the appearance it presented. From the ground up to a height of 10 or 12 feet the trunk was one swollen mass of warty protuberances and knots, covered with thick scales and flakes of hard dry bark.

This singular state of growth, the result of the practised system of tapping, has not yet been recorded by any one, and so was to me unexpected. A few minutes of careful examination soon showed the real cause of these deformities. The collector makes use of a small axe-like implement an inch broad. At each stroke he cuts through the bark and into the wood for fully an inch. Hundreds of these are made in the wood of each tree in the course of a few years, and cannot heal under any circumstances; but a layer of wood is formed over the injured part, at the expense of the bark and general vitality of the tree. The newly-formed wood is again cut into and splintered, and so the process is repeated on each successive layer until the trunk becomes merely a mass of twisted wrinkled wood, with very thin insipid bark. In this condition hardly any milk flows from the cuts; and, although for years a few green leaves may continue to sprout from the points of the twigs, yet the tree may be considered as dead, and, in fact, finally withers away. It is, therefore, the injury

done to the wood, and not over-tapping, which lessens the flow of milk, and ultimately causes the death of the tree. The cuts in the wood are of course unnecessary, since the milk is met with only in the bark. The healing over process which afterwards takes place is similar to that seen where a branch has been lopped from a trunk. The wood is compact and rather hard, and for this reason the tree lives on for a number of years, although cut and hacked every season; but the flow of milk becomes so lessened that many are practically abandoned for years before they die. This and several large adjoining trees were growing in moist deep heavy soil of a fertile character, but quite out of the reach of any inundation.

On the 2nd of August I went in search of plants, and descended to the region of the *gapós*. It had rained a good deal previously, and the collector's footpaths were ankle deep with mud. After wading several little pools, we came to a deep *gapó*, into which the tide flowed. It was connected with many lesser watercourses that formed a kind of network, extending over a wide district of forest-covered country, the more elevated parts of which were raised only from three to four feet above the highest tides. A considerable number of rubber trees grew along the margins of both the larger and smaller streams, intermixed with cacao and forest trees. Three were observed, the base of the trunks of which were flooded to a height of one foot, yet the roots seemed to run up to the brow of the bank, and no matted rootlets were observed, as is the case with the willow tree when growing on the margin of a rivulet. Most of the others occupied dry situations. Those *gapó* ditches were lined with soft rich mud, without doubt possessing great fertility. The exhalations from such places, shrouded by a forest growth of 80 or 100 feet high, were sensibly felt, and on nearly every occasion when I visited those localities I experienced slight attacks of fever afterwards. The collectors, also, during the working season are often indisposed from the same cause. Although the forest was excessively damp, yet tapping was being carried on, as a man was seen mixing up some clay at the side of a *gapó*.

A number of good plants were met with beneath the oldest trees. The seedlings did not usually grow in any place where the ground was covered by more than two or three inches of water at flood tide. However, by far the greatest number were met with on sites above the reach of the highest tides. I measured a few of the largest trees, all of which had been tapped for periods varying from 5 to 15 years. Those found growing in shallow *gapó* ditches are preceded by an asterisk. The circumference of each one yard from the ground was as follows.—

	Ft.	In.		Ft.	In.
No. 1	.. 6	9	No. 7	.. 4	0
No. 2	.. 6	10	No. 8	.. 5	10
No. 3	.. 4	7	No. 9	.. 4	0
No. 4	.. 3	0	No. 10	.. 4	6
*No. 5	.. 5	10	No. 11	.. 4	8
No. 6	.. 5	3	*No. 12	.. 2	8

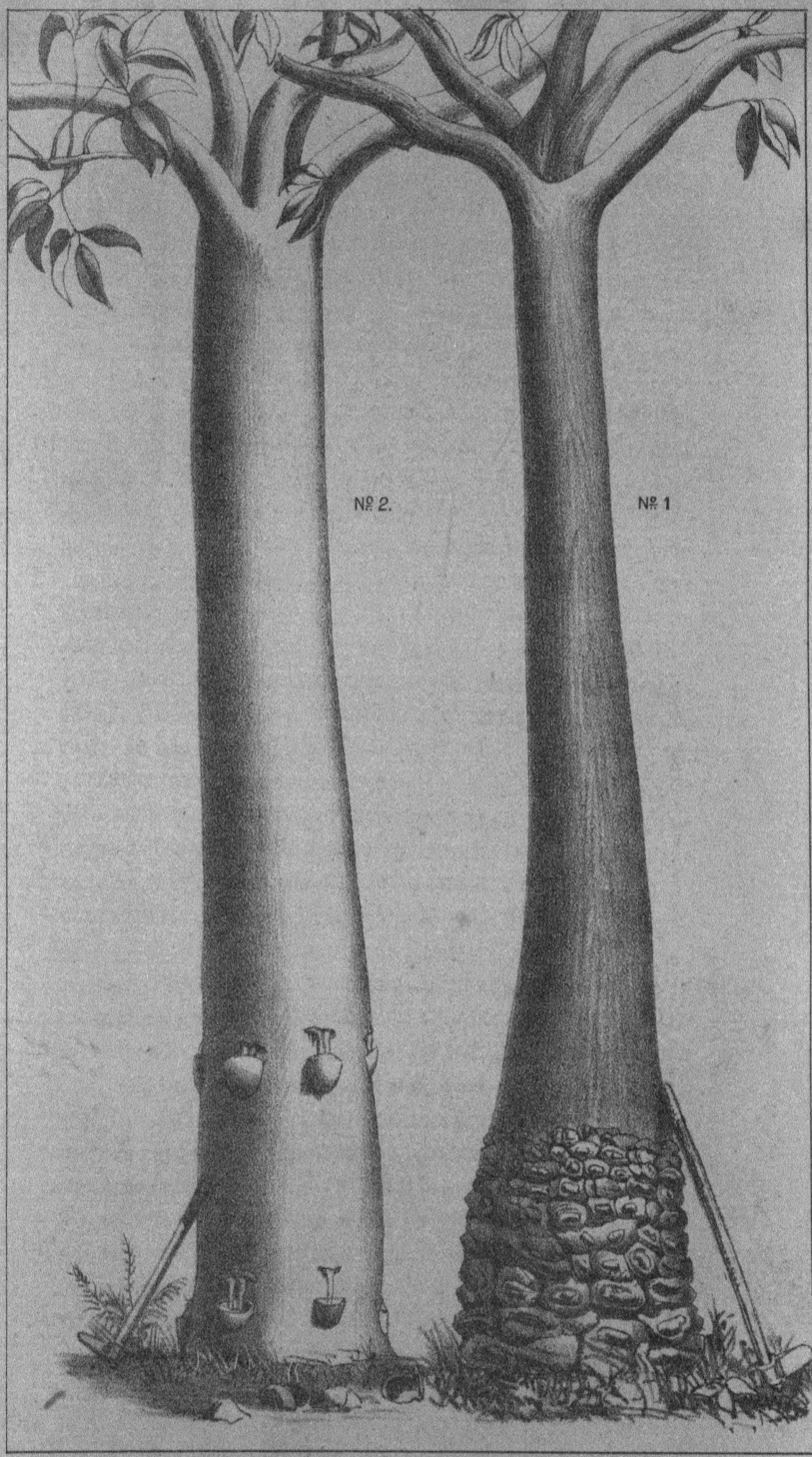
Most trees occurring within the limits of the worked districts are tapped if possessing a diameter of six or eight inches. Regularly-tapped trees, as a rule, do not exceed 60 feet in height.

August 7th.—I went in search of more plants, and on the 10th made another collection. About 2,000 in all were obtained, but a number had to be rejected. I had cases previously made, so that I was able to plant the plants in them without delay. The soil consisted of decayed leaves brought from the forest. The rougher portion was charred and put in the bottoms of the cases to serve as a sort of drainage. Then a layer mixed with some wood ashes was placed above the plants planted therein. Four cases, containing upwards of 1,000 plants, were finished in this way, one being reserved for copaiba or any other sort of rubber plants I might meet with. While the plants were being established I commenced a series of experiments, in order to ascertain how the tree might be readily multiplied in a simple rough way by any person not specially acquainted with the principles of propagation. Two separate beds, the one of brown sand, the other of decayed leaves, were formed. The terminal portion of

shoots, but with a bud at the lower end, were planted in the beds in a reclining position, with only two inches of the points above the ground. Owing to the great distance between the buds, consequent on vigorous growth, many of the cuttings were a foot or more in length. At the same time a number were set deeply in an open vessel containing only rain water. The cuttings in the sand bed were the first to grow, and soon made strong shoots and root fibres. Those in the leaf mould pushed more slowly, but developed green leaflets of great substance. The cuttings placed in the water had a small portion of tap root at the base, as the object was to determine if the roots would actually develop in water alone. Within fourteen days these plants had several roots formed, and one or two rather weak growths came up, but a few days after I had thrown into the water some burnt earth and wood ashes the increase in vigour was very apparent. After these experiences I felt convinced that the Para rubber tree delights in abundance of moisture and rich fertile deposits.

Method adopted in tapping the trees.—When the plants were somewhat established, I resolved to examine attentively the process of tapping as practised by the caoutchouc collectors. In the investigation of this subject I travelled over a very wide extent of flat forest country, much divided by miry hollows and tidal *gapós*, which stretched along the bank of the river Guamà. Although this river is at least three times as broad as the Thames at London Bridge, it is not to be seen on any ordinary map. In the region alluded to there were hundreds of trees wrought by different collectors, each of whom had a separate piece of land to work on. When on these excursions, I had to go away from my place of abode at about three o'clock in the morning, as I had some miles to travel over paths not always in good condition, and it was necessary to be as near as possible to the spot where the tapping operation was performed, because the collectors begin to work immediately at daybreak, or as soon as they can see to move about among the trees. They say the milk flows more freely and in greater quantity at early morn. I do not attach

much importance to this statement, but I have recorded it. Another and more probable reason is, that as rain often falls about two or three o'clock in the afternoon, the tapping must be done early, as in the event of a shower the milk would be spattered about and lost. The collector, first of all, at the beginning of the dry season, goes round and lays down at the base of each tree a certain number of small cups of burnt clay. At the lesser trees only three or four are put, but at the larger ones from eight to twelve are deposited. The footpaths leading from tree to tree are likewise cleared of sapling growths, and the bridges over the *gapós* formed at each place by the trunk of a tree are, where necessary, replaced. On proceeding to his work the collector takes with him a small axe for tapping, and a wicker basket containing a good-sized ball of well-wrought clay. He usually has likewise a bag for the waste droppings of rubber, and for what may adhere to the bottoms of the cups. These promiscuous gatherings are termed *sernamby*, and form the "negro-head" of the English market. The cups, as already stated, are of burnt clay, and are sometimes round, but more frequently flat or slightly concave on one side, so as to stick easily when with a small portion of clay they are pressed against the trunk of the tree. The contents of 15 cups make one English imperial pint. Arriving at a tree, the collector takes the axe in his right hand, and, striking in an upward direction as high as he can reach, makes a deep upward sloping cut across the trunk, which always goes through the bark and penetrates an inch or more into the wood. The cut is an inch in breadth. Frequently a small portion of bark breaks off from the upper side, and occasionally a thin splinter of wood is also raised. Quickly stooping down he takes a cup, and pasting on a small quantity of clay on the flat side, presses it to the trunk close beneath the cut. By this time the milk, which is of dazzling whiteness, is beginning to exude, so that if requisite he so smooths the clay that it may trickle directly into the cup. At a distance of four or five inches, but at the same height, another cup is luted on, and so the process is continued until a row of cups encircle the tree at a height of about six feet from the ground.



1. EXHAUSTED PARÁ RUBBER TREE IN A STATE OF DECAY.
2. PROCESS OF TAPPING THE PARÁ RUBBER TREE WITH CUPS.

Tree after tree is treated in like manner, until the tapping required for the day is finished. This work should be concluded by nine or ten o'clock in the morning, because the milk continues to exude slowly from the cuts for three hours or perhaps longer. I may state that there is a great difference among collectors in the performance of those duties. Some take care to get good clay previously and incorporate it well, so that a very small portion is needed to lute the cups to the trunks; they also work with neatness and intelligence, and invariably collect a good quantity of milk. Others, again, do not take the trouble to prepare clay beforehand, but merely scrape up a handful when they require it at the side of a *gapó*, which is often of little consistence, so that a large quantity is required to fasten the cups. This class of collectors have often many fragments of clay or other impurities in their milk, the result of not following a proper method of working. The quantity of milk that flows from each cut varies, but if the tree is large, and has not been much tapped, the majority of the cups will be more than half full, and occasionally a few may be filled to the brim. But if the tree is much gnarled from tapping, whether it grows in the rich sludge of the *gapó* or dry land, many of the cups will be found to contain only about a tablespoonful of milk, and sometimes hardly that. On the following morning the operation is performed in the same way, only that the cuts or gashes beneath which the cups are placed are made from six to eight inches lower down the trunks than those of the previous day. Thus each day brings the cups gradually lower until the ground is reached. The collector then begins as high as he can reach, and descends as before, taking care, however, to make his cuts in separate places from those previously made. If the yield of milk from a tree is great, two rows of cups are put on at once, the one as high as can be reached, and the other at the surface of the ground, and in the course of working, the upper row descending daily six or eight inches, while the lower one ascends the same distance, both rows in a few days come together. When the produce of milk diminishes in long wrought trees, two or three cups

are put on various parts of the trunk, where the bark is thickest. Although many of the trees of this class are large, the quantity of milk obtained is surprisingly little. This state of things is not the result of overtapping, as some have stated. Indeed I do not believe it is possible to overtap a tree if in the operation the wood is not left bare or injured. But at every stroke the collector's axe enters the wood, and the energies of the tree are required in forming new layers to cover those numerous wounds. The best milk-yielding tree I examined had the marks of twelve rows of cups which had already been put on this season. The rows were only six inches apart, and in each row there were six cups, so that the total number of wood cuts within the space of three months amounted to seventy-two. It grew close to a *gapó* only eight inches above high-tide mark, and being a vigorous tree, the cups were usually well filled, but with two years or so of such treatment the tree would probably be permanently injured. It has been supposed that the quality of the milk is better in the dry season than during the rains. Such is the case with some vegetable products; but, as regards India-rubber, there ought not, I think, to be any appreciable difference. In the rainy season the milk probably contains a greater proportion of water, but, on the other hand, I am of opinion that then a larger quantity of milk flows from the tree. No doubt the dry season is the most suitable for caoutchouc collecting, although, wherever a plantation is formed with preparing house, convenient tapping may certainly be always carried on when the weather is fine. It is a common report that the trees yield the greatest quantity of milk at full moon. In order to ascertain this, a number of very careful experiments would require to be made, extending over one or two years. Even if such an assertion was found to be true, it would probably make little difference, as tapping will have to be carried on when circumstances are most favourable.

There are two other methods adopted in tapping, which are chiefly confined to the Upper Amazon and tributaries. Both are exactly on the same principle, the materials used being only a little different. The loose outside bark of the tree

is cleaned off to a height of about three feet. Beneath, a gutter or raised border of clay is pasted or luted to the trunk, enclosing one-half or the entire circumference. Cuts are thickly made in the bark above this, from which the milk flows down to the gutter, whence it is conveyed to fall into a calabash conveniently placed. The other mode is by winding round the trunk the stout flexible stem of a climber, and claying it round securely so that no milk may escape between the trunk and the climber. These plans are not extensively adopted, and can only be successfully put in practice where the trees have not been previously tapped. There is always a great deal of "negro-head," the result of the distance the milk has to run, and to the large quantity of clay employed in the process.

Collection of the Milk.—Going from tree to tree at a sort of running pace, the collector empties the contents of the cups into a large calabash, which he carries in his hand. As he pours the milk out of each cup he draws his thumb or forefinger over the bottom to clean out some which otherwise would adhere. Indeed, a small quantity does remain, which is afterwards pulled off and classed as *sernamby*. The cups on being emptied are laid in a little heap at the base of each tree, to be ready for the following morning. The trees occur at various distances from 10 to 100 yards apart, and as I travelled over the intricate network of muddy footpaths, I continually felt perplexed and surprised that the natives have not yet seen the advantages that would be derived by forming plantations, whereby more than twice the quantity of caoutchouc might be collected in one-fourth the time, and at far less cost and labour.

Method of preparing the Rubber.—The collectors of the region I visited, resorted with their milk to a large shed situated on the bank of the river Guama. Here were quantities of various species of palm nuts, representing an *Attalea* and *Euterepe edulis*, stored in heaps, and several jars for the preparation of rubber. These jars were 18 inches high, and the bottoms were broken out. At the base they were 7 inches

in diameter, bulging out in the middle to 12 inches, and were narrowed at the mouth to a breadth of 2 inches. Each person wrought on his own account, and so small jars were employed, but where a number of men are collecting for one master much larger jars are in use. The milk, on being put into a large flat earthen vessel, is put down on the floor in a convenient place. Adjacent thereto the jar is set on three small stones, which raises it to 1½ inches above the floor. The narrow space between the base of the jar and the floor allows the air to enter, which causes a current of smoke to ascend with remarkable regularity and force. When the fire commences to burn strongly, several handfuls of nuts are put on, then some more wood and nuts alternately. These are dropped in at the mouth of the jar until it is filled to within four inches of the top. Due care is taken that a sufficient proportion of wood is put in with the nuts. The mould on which the rubber is prepared resembles the paddle of a canoe; in fact, at many places on the Amazon this is the article most frequently used if there is much milk, and when the rubber is prepared in bulky masses. Occasionally the mould is slung to the roof, as the weight in handling it during the process would otherwise be very fatiguing. A little soft clay is rubbed over it to prevent the rubber from adhering, and it is afterwards well warmed in the smoke. The operator holds the mould with one hand, while with the other he takes a small cup and pours two or three cups of milk over it. He turns it on edge for a few moments above the dish until the drops fall, then quickly places the flat side two inches above the jar mouth, and moves it swiftly round, as if describing the form of a cipher, with his hand, so that the current of smoke may be equally distributed. The opposite side of the mould is treated in the same way. The coating of milk on the mould on being held over the smoke immediately assumes a yellowish tinge; and, although it appears to be firm on being touched, is yet found to be soft and juicy, like newly-curdled cheese, and sweating water profusely. When layer after layer has been repeated, and the mass is of sufficient thickness, it is

laid down on a board to solidify, and in the morning is cut open along the edge on one side and the mould taken out. Biscuit rubber, when fresh, is often four or five inches thick. On being hung up to dry for a few days, it is sent to market. When I saw the process of smoking the rubber performed, as just described, I was considering the statements of Keller and other travellers who write on this subject, all of whom seem to believe that the smoke from the palm nuts possesses some peculiar or strange property by which means the milk instantly coagulates. But on one occasion, when the collector was commencing to smoke some milk, I saw him wait for a short time, during which he put his hand repeatedly to the mouth of the jar, and soon learned that he could do nothing until the smoke was hot. The dense white smoke rose abundantly, but the milk would not thicken on the mould. After a little while the jar became heated, and the operation went on quite satisfactorily. I put my hand above the mouth of the jar, but could not bear the heat scarcely a second; and, although the temperature of the smoke was apparently less than boiling water, yet I judged it must have been at least 180° Fahrenheit. Therefore the rapid coagulation of the milk is simply produced by the high temperature of the smoke. I have no doubt that, with a strong current of heated air, or a good pressure of steam from a pipe, a similar result would be obtained. The finely divided particles of soot which forms a large proportion of the smoke, undoubtedly absorbs a considerable amount of moisture, although at the same time it must be looked on as an impurity. I have no hesitation in giving my opinion that equally as good rubber could be prepared by putting the milk in shallow vessels, and evaporating the watery particles by the heat of boiling water.

Temperatures of the Para Rubber District.—I now proceed to give the temperatures taken during my stay in the region of Para. According to the natives the rains begin in November or December and end in June. However, during the intervening months of summer it will be seen that showers of rain are frequent. These usually occurred between two and three o'clock in the afternoon, and streamed down with a force

similar to the monsoon showers in India. The days on which rain fell are preceded by an asterisk.

1876.	Morning.	Noon.	Night.	1876.	Morning.	Noon.	Night.
	°	°	°		°	°	°
July * 17 ...	—	88	81	September 2 ...	76	86	84
„ * 18 ...	79	88	81	„ 3 ...	73	89	85
„ 19 ..	80	87	83	„ 4 ...	84	92	83
„ * 20 ...	79	86	79	„ 5 ...	82	91	81
„ * 21 ...	79	87	79	„ *6 ...	73	90	82
„ 22 ...	77	86	85	„ 7 ...	73	91	81
„ * 23 ...	79	87	83	„ 8 ...	76	89	81
„ 24 ...	79	87	85	„ 9 ...	76	88	83
„ * 25 ...	79	89	83	„ 10 ...	75	90	77
„ 26 ...	79	87	84	„ *11 ...	76	89	83
„ 27 ...	80	87	84	„ 12 ...	75	89	81
„ * 28 ...	79	88	81	„ 13 ...	74	88	82
„ * 29 ...	77	89	83	„ 14 ...	75	87	81
„ * 30 ...	81	90	84	„ 15 ...	76	89	83
„ * 31 ...	80	86	82	„ *16 ...	75	90	81
August 1 ...	79	80	79	„ 17 ...	74	88	84
„ 2 ...	77	86	83	„ *18 ..	73	87	81
„ 3 ...	78	87	85	„ 19 ...	74	87	83
„ 4 ...	79	87	83	„ 20 ...	73	89	80
„ *5 ...	79	89	83	„ 21 ...	74	88	83
„ *6 ...	79	87	84	„ 22 ...	73	89	83
„ 7 ..	77	86	83	„ 23 ...	75	91	82
„ 8 ...	80	88	84	„ 24 ...	76	90	84
„ *9 ..	80	88	83	„ 25 ...	75	87	83
„ 10 ...	79	89	84	„ 26 ...	74	92	81
„ *11 ...	78	87	82	„ 27 ...	75	92	84
„ *12 ...	80	86	80	„ 28 ...	74	93	85
„ *13 ...	79	87	82	„ 29 ...	75	92	83
„ 14 ...	77	84	81	„ 30 ...	76	92	85
„ 15 ...	77	87	82	October 1 ...	74	91	84
„ *16 ...	77	85	81	„ 2 ...	74	92	85
„ 17 ...	78	88	84	„ *3 ...	75	91	84
„ 18 ...	79	88	83	„ 4 ...	74	87	82
„ *19 ...	78	88	82	„ 5 ...	76	90	84
„ *20 ...	78	87	81	„ 6 ...	75	89	85
„ 21 ...	79	88	83	„ *7 ...	74	88	84
„ 22 ...	77	89	82	„ *8 ...	75	89	83
„ 23 ...	78	89	82	„ *9 ...	74	88	82
„ *24 ...	77	88	82	„ 10 ...	76	87	84
„ 25 .	79	87	81	„ 11 ...	75	89	83
„ 26 ...	77	86	84	„ 12 ...	75	88	84
„ 27 ...	78	87	83	„ *13 ...	76	87	81
„ *28 ..	79	85	81	„ 14 ...	74	89	83
„ *29 ...	76	87	82	„ 15 ...	75	90	84
„ *30 ...	77	86	81	„ 16 ...	75	90	82
„ *31 ...	78	87	82	„ 17 ...	75	89	85
September *1...	76	86	83				

A glance at these figures will show that the region of the Para rubber tree has a sustained high temperature—a fact which has already been remarked by Dr. Spruce and other travellers. The lowest I could record was 73°, but Mr. Henderson assured me he had frequently seen it down to 72°, and I have the statements of another observer, on whom I coulp

rely, that on one occasion the thermometer fell to 65°. The place, however, where this observation was made was fully 100 miles to the westward of Para. In the neighbourhood rubber trees abounded.

Sites, propagation, and planting in India.—The sites most suitable for the planting of this tree will be found in the hottest parts of India. The flat, low lying, moist tracts, lands subject to inundation, shallow lagoons, water holes, and all descriptions of mud accumulations, miry swamps, and banks of sluggish streams and rivers, will be found best adapted. The tree will also grow perfectly in deep humid land, fitted for cane or coffee planting. The Malay Peninsula, Burma, the island of Ceylon, and the southern portion of India on to about as far north as 20° north latitude, should possess many localities proper.

The temperature of rain-water varied from 74° to 75° for planting ; but in no place would I recommend the formation of a plantation where the thermometer at any time falls below 60° Fahrenheit.

It seems to me that the propagation and planting may generally be combined in one operation, the object being to reduce the expense, simplify and accelerate the work, and promote the more perfect development of the primary roots and trunk. The green coloured terminal shoots of succulent growth, with the leaves fully matured, make the best cuttings. These should be cut off low enough, so that there is a joint at the base. When it is desirable to plant in dry firm land, a spadeful of soil should be turned over at each place, and the cutting planted in a sloping position. It should be covered with mould to within three inches of the point. That portion above ground should rest on the earth on one side to its termination, so as not to suffer during hot sunshine. In all stages the crowns of the plants may be exposed to the rays of the sun. Plants intended for cutting stocks may be planted in open places, in the richest dark loam capable of producing a luxuriant rank crop of sugar cane. Seeds might be planted out permanently at once, also in the same way as the cuttings. These would prosper much better if at the time of planting

a handful of wood ashes were added to the soil with each seed. Good ashes may be obtained by the burning of any description of green wood or newly felled piece of forest. If the wood is allowed to rot before burning almost the whole of the fertilizing principles will be found to have vanished. If stored in a damp place the value of the product is diminished. For planting on inundated lands the period of high flood should be preferred. Cuttings of greater length would be required in this case, the lower ends of which should be sliced off in the form of a wedge. The workman could take a bundle of these, and wading into the water would plant at proper distances, but perfectly upright, taking care to push each cutting down deep enough in the soft muddy bottom, so that not more than three or four inches is above the surface of the water. The same rule would be applicable when planting in sludge or soft marsh land. The crowns of the cuttings must not, if possible, be put under water, as the young growths springing therefrom might rot. Seeds will not be found very applicable for planting in watery places or deep mud deposits. Some would come up, but a good many would mould and decay. In the varied course of circumstances and conditions, slight changes and modifications in the methods of working will no doubt suggest themselves. I would not advocate, at least for the present, the extensive planting of this tree in fertile cane-producing lands, because in such a description of soil it would not be able to compete with the Central American rubber tree, already introduced from the State of Panama, which grows rapidly to a much greater size, and yields a far larger quantity of caoutchouc. It should rather be planted in places where nothing else could be profitably cultivated, such as frequently inundated river margins, marsh land, and mud deposits. Above 4,000 tons of Para rubber are exported annually.

Search for plants of the tree yielding the Balsam of Copaiba, Capivi of commerce.—I was recommended by Mr. Markham, just before leaving, to endeavour to obtain at Para some plants of this tree, which abounds in the forests of the Amazon valley. These balsam trees have a wide distribution, and are

likewise found dispersed in the forests of Guana and Venezuela, and in the wooded littoral districts of New Granada, especially in the States of Santa Martha, Carthagena, and Panama. In those regions different species of trees varying in size and yield, furnish balsam, but all are leguminous, and belong to the genus *copaifera*. The finest sort in commerce, called by the collectors white copaiba, is met with in the province of Para, and is shipped from Para and Maranham. Very large quantities are annually sent to the French market.

After protracted inquiry I discovered that few people really knew the tree, and I was beginning to think that I might not be able to obtain any knowledge of it, when fortunately I learned where a practical copaiba collector lived. Formerly the tree might be seen growing in places easy of access, but owing to the method of collection practised it is now comparatively rare. At present a collector must make a journey, occupying several weeks, in a canoe up some of the Amazon tributaries, or penetrate into the dense forest lying between the rivers, to find any considerable quantity of copaiba.

It cost me three successive journeys on foot, occupying three days, before I could arrange with the collector. He was drinking a supply of cane rum (*cachass*), and he would not go anywhere until it was finished. Few occupations are so perilous and fatiguing as that of the balsam collector. Exposed daily to the drenching rains in the depths of the forest, with often an insufficiency of food, bitten by large formidable ants, and tormented unceasingly by day and night by swarms of mosquitoes, his life is of a wretched description. When living under these conditions the smallest scratch from the underwood is apt to become a sore, and increase to the size of a florin in forty-eight hours. On the 17th of September I left with the lad, and joined the collector at the entrance to the forest. The path led through a dense lofty vegetation, the majority of the trees being from 80 to 100 feet in height. The extremely fertile soil was of soft white sand, 20 feet or more in depth, covered by a thick surface layer of vegetable mould with which the sand was intermixed. Slight undulations were traversed, and three little running streams were

crossed, none of which contained more than a mill of water. The land was everywhere quite mealy and dry, and was elevated at least 50 feet above the region of the *gapós* or tidal floods. Large black ants, some of which were nearly two inches in length, called by the natives *candela*, ran over the ground everywhere. The bite of this ant is quite as painful as the sting of a wasp in this country. After travelling several miles we came to a balsam tree of gigantic dimensions. The saplings had been cut down around it by a person who lived some distance away, and who consequently was considered the owner. The tree appeared to be 80 feet in height, with a clear trunk of 50 feet. On account of the great thickness of the trunk, and absence of branches, no one was able to climb it. The clearing away of the underwood admitting freely air and light had induced the tree to bear seed, which, however, was just beginning to ripen. Little perpendicular rents were observed in the bark of the trunk from eight inches to a foot in length. From some of these, which had occurred quite recently, a little balsam had exuded, and flowed down the trunk. A diligent search for plants was made, and one small seedling was found by the collector, which I rejected, as I doubted whether it was really a balsam plant. Without much loss of time we continued our journey along a narrow path lined with tall grass and shrubs. At mid-day we came to some copaiba trees, one of which had been tapped some years ago. It had a massive lofty trunk, and wide spreading crown, and must have borne many crops of seeds, but not one plant was to be met with. A further search beneath a number of other trees which were scattered about proved alike fruitless. The collector explained that the seeds on falling were immediately eaten up by an animal about the size of a rat. This fact fully accounted for the scarcity of seedlings. Everywhere underneath the trees a close network of little paths traversed the ground. We penetrated this day into the forest for a distance of 12 or 14 miles, and got neither plants nor seeds. I had a little fever afterwards for about a day, which, although mild, weakened me considerably. I felt that the daily exposure in the sun afterwards fed the symptoms which remained.

On the 9th of October I took with me the lad, and returned to examine the copaiba tree in fruit already noticed. A number of capsules were found beneath it, but all were empty. The ground was thickly covered with the little paths of the animal which had devoured the seeds. Whilst engaged in searching about a gentle breeze of wind arose, which, moving the branches, brought down a few seeds in the best possible condition. These were carefully gathered, and in all 18 seeds were collected. Each little pod contains only one seed, which is coated over with a white wax-like substance, possessing a delicious aroma. When this is removed the seed is found to be black, and about the size and form of a field bean. The time was at hand when I purposed to leave with the rubber plants, so as to get to England before the cold weather set in, but I resolved, if possible, to see the method of tapping the trees actually performed. This operation has not yet been accurately described by any traveller, and no scientific work or class book in the English language gives a correct account of the process, for which reason I take the liberty of recording my observations.

Early in the morning of the 13th October I proceeded to the forest, accompanied by the lad and the copaiba collector. To each was assigned a fair travelling load, consisting of food or other necessities, but the most prominent object was a large tin capable of holding about 40 English pints, which the collector carried on his back. We travelled by a path to a point beyond the place reached on a former occasion, and then diverged into the forest, where there was no track of any kind. Entering on a district where the trees were an amazing height, we in a short time came to a very large copaiba tree. This, and a number of others, were previously known to the collector, who tapped one or two when convenient. I found he did not want the lad to see the largest of these trees, lest he might show them to others. On reaching the tree, he struck the trunk two or three blows with the handle of his axe, when a sort of hollow sound was produced. The grand symmetrical trunk was clear of branches to a height of at least 90 feet, above which the crown spread out flatly, the slender interlaced boughs, clothed

with little pinnate foliage, forming an agreeable shade from the rays of the sun. The circumference at 3 feet from the ground was 7 feet 2 inches. Several old fissures in the bark were observable, and one, which had occurred quite recently, was nearly 5 feet in length. Very little balsam had exuded. These rents are reported to be occasioned by the accumulation of oil in the tree, and that when they happen a loud report is heard.

The person who successfully taps a copaiba tree must be a skilful axeman. A chamber or cavity is cut in the trunk, not much broader than the axe, but sufficient to allow the workman to vary the course to the heart of the tree in such a way that he may not miss what is termed the "vein" or channel, usually met with near the centre, from which the balsam flows. The base or floor of the chamber must be carefully and neatly cut with a gentle upward slope, and it should also decline to one side, so that the balsam on issuing may run in a body until it reaches the outer edge. Below the chamber a pointed piece of bark is cut and raised, which, enveloped with a leaf, serves as a spout for conveying the balsam from the tree to the tin.

The collector commenced the work by hewing out with his axe a hole or chamber in the trunk about a foot square, at a height of two feet from the ground. The wood at first was white to a depth of four or five inches, when it changed to a purplish red, very much resembling a piece of old oak taken from a peat moss or bog. The whole of the interior of the tree is of this colour. When the centre appeared to be reached, I was about to remark that there was no balsam, when suddenly the collector laid down his axe and called hastily for the tin. The balsam now came flowing in a moderate sized cool current, full of hundreds of little white bubbles possessing a pearly transparency. At times the flow stopped for several minutes, when a singular gurgling noise was heard, after which followed a rush of balsam. When coming most abundantly a pint jug would have been filled in the space of one minute. Owing to the diminished light consequent on the thick masses of foliage overhead, I could not distinguish

the "vein" in the heart of the tree, but I observed a number of fissures that appeared to radiate from the centre outwards. Whilst making these observations I was surprised to see that the whole of the wood cut through by the axeman was bedewed with drops of balsam, and so also were the ends of the chips. This remarkable and important fact shows that every atom of wood in the tree contains a certain amount of copaiba. The bark did not appear to possess a particle. In the course of an hour nearly one-fourth of the tin was filled. A little roof, thatched with leaves, was placed over it as rain began to fall heavily. We then returned home. The collector considered the tin would be filled, and proposed to return for it in a couple of days. Although balsam may be seen slowly dropping from a tapped trunk for a month after it has been operated on, the common practice is to allow a tree, if it be good, only two or three hours to drain, and then to proceed to another. Occasionally large trees are met with which when tapped yield little balsam. The cause of this has not been ascertained. Trees of the largest size in good condition will sometimes yield four "potos," equal to 84 English imperial pints. A collector, where trees are abundant, and with plenty of vessels, can, it is said, make at the rate of 5*l.* per day. Mr. Clough, an English missionary, in describing in a recent work* the method of collecting balsam, says that it "is obtained by making a gash in the bark of the tree, and plugging the space with cotton, to absorb the juice which exudes." I will venture to state that not a drop would be obtained by this process. Nor is the practice, as stated by some, of closing the cavity cut in the tree for a time with clay or wax, to allow the balsam to accumulate, ever resorted to. Even if tried it would not answer, for a number of reasons. Balsam, as it comes from the tree, has a powerful pungent fragrance, which is not particularly disagreeable, although on passing the doors of the houses where it is stored at Para an odour, by no means pleasant, is experienced. Possibly some change may take place in keeping. Little, if any, care seems to be taken

* "The Amazon A Twelvemonth's Tour," by S. Clough.

to preserve the commodity pure. Those who go up the rivers to collect on a large scale take in their boats all descriptions of jars and barrels which may have been imported with liquors, grease, or any kind of article. Paraffin cans are special favourites, and so are much sought for. Most of those vessels, on being emptied, are stowed away in dusty places, uncorked and uncovered, thus affording free ingress to ants, spiders, and all classes of insects. It is urged by some that balsam precipitates all impurities, but even if this were so, a better system might be adopted. As some of the seeds brought home have germinated at Kew, I may add a few remarks regarding the cultivation in India, whether a few plants should be sent when strong enough for removal. I trust care may be taken at Kew to keep this sort separate from other species cultivated there, mostly natives of the West Indies, and which, although interesting in what may be termed a "botanical sense," are of no value for the production of copaiba. The temperature required is the same as that for the Para rubber tree, which at times is found growing beside it. Wet or marsh land must be avoided. The site should be of the best dry loam, suitable for cane or coffee planting. The stock for planting will have to be obtained from seeds ripened in India, so that, if a few plants can be transferred thither, they should be planted in good situations, where plenty of sunshine is admitted, in order that seed may be early produced. Seedlings may be planted tolerably thick, so as to shoot rapidly up, when they can be thinned out to proper distances.

I would not recommend the planting of these trees on a large scale with a view to early profit, as the growth would be slower than Panama or Para rubber trees. The return would, I think, be realized in about the same time as is the case with oak plantations. However, a few hundreds of copaiba trees growing on a planter's estate ought to enhance the value of it. Apart from the medicinal value of copaiba, it might be well to ascertain if it would not be equal to castor oil for lubricating machinery. The journeys relating to this work were among the most fatiguing I have experienced in these countries.

Examination and collection of seeds and plants of Ceara

India-rubber.—On the morning of the 26th I went on shore at Ceara, as I wished to gain some knowledge of the method adopted in the preparation and collection of the rubber exported from Ceara. I had to land from the ship in a *jangada*, which is a raft 12 or 14 feet in length, formed of moderately-sized trunks of a tree fastened together, and furnished with a mast and large sail. A piece of board, a foot in breadth and four feet long, is pushed down in the middle between two logs, to serve as a keel. The tree selected for those rafts has a peculiarly light wood said to be brought from Bahia or Pernambuco. With a good fair wind they are said to run sometimes at the rate of 15 knots an hour. The surf is so strong that no boat or canoe could often reach the shore safely. Even the *jangadas* are sometimes overturned, and when this happens there is a risk in getting a blow from the timbers of the raft—a danger considered greater than the sea. In the town I saw a large quantity of rubber in a merchant's store, and afterwards observed that it was freely traded in by most classes of shop-keepers. I expected to have seen the tree yielding it somewhere near, but after travelling about over the sand-hills and adjoining country for the greater part of the day, I returned to the ship completely tired. I was assured by a native, who said he knew the Para rubber tree and that of Ceara, that both were completely identical. But the great diversity in the climate induced me to think different, and so I resolved to follow out the dictates of my own judgment, and not be influenced by any one until I could satisfy myself on the matter. Yet there was little time to explore, as the steamer was expected to leave in a very few days. Next morning an Indian from the interior happened to come on board the ship, and I took the opportunity of asking him the names of some of the villages and localities in the retired districts. I knew from previous travelling a good number of the Indian substantives, with their meanings, and this, together with further conversation, enabled me to form some idea of the character of the region where the rubber was collected. A single line of rail, formed to facilitate the transport of sugar and cotton, runs from Ceara into the interior to a place called

Pacatuba, distant about 40 miles. Contiguous are a number of large plantations with some slaves. On Sunday, October 29th, I landed with the *jangada,* and proceeded through the town to the railway station. I had previously arranged with a native to accompany me, but he did not appear, so I went off alone. Leaving Ceara, a flat parched-up region was traversed, diversified by a few undulations and moist hollows. Thorny thickets of bushes and slender trees, chiefly myrtles and legumes, overspread the country, with many groups of the Carnaúba palm, *(Copernicia cerifera)* rising high above the ordinary vegetation. The crowns of these palm trees waved about by the wind and visible over such a wide expanse presented an appearance extremely picturesque, whilst in the distance beyond rose a multitude of conical peaks and mountains, the whole combining to form a landscape of surpassing beauty. After a journey of two hours I stopped at a little village with about a dozen thatched houses, called Maracanahu. The distance may be 30 miles from Ceara. I went to a man and boy who were standing in front of a hut, and made some proposals to them to show me the locality where the rubber trees grew. The man was advising the boy to accompany me, who seemed rather reluctant, when a poor lad, who had lost an arm, came up and at once consented to go with me. It was fortunate I met with this one-armed lad, as I could hardly have succeeded so well with any one else. I told him I wanted first to see trees that were being wrought, because I wished to make sure of the tree, and also observe the method of collection. We proceeded along a dusty path for some distance, at times running, as I proposed, if possible, to return with the train which passed the village in the evening. Plantation establishments were seen dispersed at wide intervals over the country. Cultivation was only carried on in very low moist situations, or where the water during the rains was stored up in artificial ponds for irrigation. Some of these were so large that at first I took them to be natural lakes. After travelling for some time the lad turned from the path and dived into the forest. In a few minutes he brought me among a number of rubber trees which had recently been bled. The general forest was toler-

ably high, but the sparse small foliage did not afford much shade from the fierce rays of the sun. The soil was in places a sort of soft sandstone or gravel, which was bound up in the most extraordinary manner. Neither grass nor weeds grew among the underwood, and there was an entire absence of ferns, mosses, and other plants. I soon saw that the tree was totally different from the rubber tree of Para, and also that it would probably thrive perfectly over a very wide extent of the drier regions of India. At first sight it much resembles in appearance a birch tree, and the surface or epidermis of the bark comes off in the same way in thin silvery peelings. The largest of the trees were about 50 feet in height, with trunks nine inches to a foot in diameter. The crown is divided into many branches, which grow in the form of a basket. The tree is deciduous, and there were neither leaves, flowers, nor fruit to be seen. I spent some time in examining attentively the process of bleeding the trees, and then commenced to search for plants. A few were found growing in an open space, but the roots were so firm that not one could be pulled up. It seemed strange that the lad and myself, exerting all our strength, could not pull up a young seedling plant about two feet high. I went and got a pointed branch of a hard wood tree,* and scraped and dug about the roots, and in this way, with very arduous work, during which I hurt and lacerated my hands, some plants were got up. The real difficulty was now apparent. The roots of the plants were furnished with tubers, the largest of which were about the size of kidney potatoes. These tubers, although quite near the surface, adhered with such tenacity to the sandstone, or hard gravel, that most of them had to be smashed in order to get away an uninjured portion of root with the stem. In the young state they are soft and spongy, and are seen to contain milk, but afterwards become lengthened out, and form a part of the root. With diligent search and hard labour we succeeded in collecting 18 plants. At the station, a number of natives from Ceara gathered round the "bundle of sticks," but could not make out

* It seems strange that Mr. Cross should have gone out without tools.—Ed.

what they were. However, an old man from the forest district came up, and, peering through the crowd said, "Manisoba." This is the Indian name of the rubber tree, which I knew before. I got back to Ceara just before dark, and fortunately found a *jangada*, which put me on board. Thus in one day I was fortunately able to discover the origin of a tree, hitherto unknown and undescribed, yielding an important article of commerce, and at the same time resolved the mode of collection and preparation, and secured a number of plants. It is true I had no instructions regarding this Ceara rubber plant, probably because it was supposed to be the same as the Para tree. But I thought it would be well to secure more plants, and told the owner of the *jangada* to come for me in the morning. This sort of raft was expensive; each voyage cost me three *milreis* (6*s*.), and I could not possibly have got one for less. The distance was only about three hundred yards. Next day the sea was very rough, and three *jangadas*, one of which carried the Brazilian Government mails, were overturned in the surf. The person I arranged with came for me, and I embarked. Although I was not in the least alarmed, the size and violence of the waves completely surprised me, while the *jangada* at full speed went groaning through the surf, covered by nine inches or a foot of water. I cannot help wondering that not a farthing has been spent in improving the safety of these Brazilian ports.

Returning to Maracanahu, I proceeded to an adjacent house, where I was previously told I could stay. The son of the owner assisted me in obtaining a quantity of seeds, 700 in all. The pods when ripe burst and go to pieces, and so the seeds are showered on the ground. At daybreak next day we went in search of plants. We brought a strong iron hoe, as my intentions were to take up a good number, for I did not place much confidence in the seeds, although I am glad to state they have turned out well. Our course was directed to a more distant part than I had previously visited. Shortly after entering the bush-like forest we came on a large tract of land covered by immense masses of grey granite, some of which might be 50 tons or more in weight. These had been broken

where they lay, and were the result of a volcanic explosion. Rounded masses of the same rock also cropped out in many places. Travelling now became very difficult, as we had occasionally to scramble from one block to another on our hands and knees. Many good-sized rubber trees were growing in the spaces between those granite masses, but no plants were seen. The situation was very dry, but no doubt some seedlings had sprung up, which, owing to numerous thickets of shrubs, were not perceived. After fully an hour of tiresome exploring I resolved to go back to the place where I got plants previously. We there succeeded in collecting a number, which, with those formerly gathered, amounted in all to 60. The handle of the hoe broke, for which reason the work was not further prosecuted. Taking with me the seeds and plants, I returned to the steamer in the afternoon.

System practised in bleeding or tapping the trees, and collecting the Rubber.—This is an operation of a very simple description. On commencing to work the collector takes with him a stout knife, and a handful of twigs to serve as a broom. Arriving at a tree, any loose stones or dust are swept from the ground around the base, and some large leaves are laid down to receive the droppings of milk which trickle down. Some do not go to the trouble of sweeping the ground or laying down leaves, for which reason the milk adheres to sand, dust, decayed leaves, and other impurities. The outer surface of the bark of the trunk is pared or sliced off to a height of four or five feet. The milk then exudes, and runs down in many tortuous courses, some of it ultimately falling on the ground. After several days the juice becomes dry and solid, and is then pulled off in strings and rolled up in balls, or put into bags in loose masses. Only a thin paring should be taken off, just deep enough to reach the milk vessels; but this is not always attended to. Nearly every tree has been cut through the bark, and a slice taken off the wood. Decay then proceeds rapidly, and many of the trunks are hollow. In this condition the trees must yield far less milk, and many, no doubt, are broken over by the wind or wither away. Collecting is carried on during the dry season only when rain seldom falls.

Climate and Temperature.—The flat country from Ceara, running back to the mountains, in which the tree abounds manifestly possesses a very dry arid climate for a considerable part of the year. This is evident from the fact that mandiocca and other crops require to be irrigated. The rainy season is said to begin in November and end in May or June. Torrents of rain are then reported to fall for several days in succession, after which the weather moderates for a brief space. According to some statements, there are occasional years in which hardly any rain falls. This assertion concurs with the aspect presented by the country in general. The daily temperature on board the ship ranged from 82° to 85° Fahrenheit, but inland it is often probably 90°.

The localities traversed by me nowhere seemed to be elevated more than 200 feet above the sea. The situations selected for cultivation in India should possess a rather dry and sustained high temperature. In the comparatively low-lying coast country of the southern portion of the peninsula of India, including the districts of Madras, Cochin, Calicut, Cannanore, Mangalore and Bombay will be found many localities possessing all the conditions essential for the growth of Ceara rubber. The plant might likewise be tried in the deep tropical valleys of Assam, and, indeed, in all the parched regions of India within the limits of coffee planting. It may not be safe, at least until some experience is gained, to plant in any locality where the temperature at any time of the year falls below 50° Fahrenheit.

Propagation and Planting.—Seeds are early produced if the tree is not shaded. They should be buried in brown sand, kept pretty moist until there are indications of growth, when they may be planted out permanently. In some situations where the ground is rough and strong they might be sown broadcast. Meantime I would suggest the formation of plantations by cuttings, which will take root as easily as a willow. These should be taken from the points of strong shoots, and may be one foot in length. In planting, each cutting may be put down in the soil to a depth of six inches. If scarce, the entire shoot may be cut into pieces, each possessing a bud, all

of which will grow if covered with half an inch or so of soil. On loose sandy soils or exhausted coffee land, plantations may be formed at little expense. Dry, hard, gravelly wastes, if found to support any kind of bush, are also suitable sites. Holes might be made in strong land with an iron jumper, and a stout cutting put into each and filled with pebbles. On bare or thinly-covered portions of rock the cuttings might be laid down flat, and a little heap of stones or any kind of *débris* about the size of a molehill, piled over each, care being taken that the extreme point of each cutting with a bud is left uncovered. I do not advocate planting in an entirely barren desert, but wherever there is any sort of stunted tree or scrub vegetation, with an occasional sprinkling from a monsoon shower, the tree is likely to prosper. Ceara rubber occupies a position in the market. The export has been stated to amount to 1,000 tons per annum.

Arrival in England.—The steamer left Ceara on 2nd October, and arrived at Liverpool on the 22nd of November. The plants were deposited at Kew early on the morning of the 23rd. There were fully 1,000 plants of Para rubber, *Hevea Braziliensis*, in the best condition. Exclusive were the Ceara plants, all of which arrived sound and have done well.

I have looked at the collections of dried plants in the State Herbarium at Kew, but no specimen could be found of the Ceara rubber tree. Judging from pieces of the capsules and the seeds, it would seem to belong to the same family as the Para sort. From the fact that it has tubers attached to the roots, Professor Oliver, the Curator of the Herbarium, suggested its similarity to the mandiocca (*Manihot*), and this in some respects is really the case. The tubers are probably poisonous, which, however, is a prominent feature of the *Euphorbiaceæ*, but in the form, markings, texture, and liability to rot when cut or bruised, they strikingly resemble some varieties of mandiocca.

Observations relating to the Rubber-producing Tree of Central America.—I will now add a few remarks concerning this tree, which I collected in the interior of the Isthmus of Panama towards the latter end of 1875. This, because I think it has

not received the attention it deserves. There are now a good collection of plants at Kew, and I am surprised that more have not been sent to India.

The tree inhabits wooded regions near Guayaquil and Buenaventura, and has likewise been met with abundantly in the State of Panama, and in the Republics of Costa Rica, Nicaragua, Honduras, Guatemala, and Mexico. It is one of the largest and most massive of the trees of western tropical America. The trunk often attains to a surprising thickness and height, yielding in some instances above a hundred pounds of India-rubber. The wood is extremely soft, and when cut into decays rapidly. The destructive method of cutting down the tree to be tapped has exhausted extensive rubber localities; and, although others may be opened up, yet the supply is certain to diminish at no distant date. Even where the trees are not felled, as in Nicaragua, the method of tapping, by which the wood is injured, is so unskilful that it has been considered by some as preferable to cut the tree down at once. The climate of various of those rubber districts is hostile and severe, and some places, such as the forest regions of Buenaventura and Choco, have no parallel in the universe. Throughout the State of Panama drenching rains are almost of daily occurrence, and occasionally on the Atlantic side hurricane blasts make avenues in the forest.

The district investigated by me, and where the plants were collected, was reached by ascending for some distance the River Chagres, and then travelling for several miles through a stately forest into the heart of the isthmus. The trees seen exceeded in height and dimensions those met with in the wooded districts of the Amazon. An undergrowth of a thorny wild pine apple (*Bromelia*), 10 feet in height, everywhere formed extensive thickets. Large powerful snakes were numerous, and so audacious that they deliberately rose up to strike at any one that approached. The young rubber saplings were found growing most abundantly on the banks of cool, clear running streams and little dribbling rivulets. The roots could easily be traced over the surface of the ground running down to the very margin of the water. But the tree grew also on emi-

nences, steep declivities, and varied elevations, and in such abundance that the first explorers gave the name "Caoutchouc Hill" to a height which they found crowned with a forest almost entirely composed of rubber trees. It was not seen growing anywhere on swamp or marsh land. Although the rubber districts are proverbially rainy, yet the tree was seen by me growing beside a stream on the border of a desert tract of country bounding the Gulf of Guayaquil, where only a few light showers of rain fell during the year. On both sides of the stream there was a strip of good forest, but beyond thickets of cacteæ and low spreading legumes formed the characteristic vegetation. I mention this fact to show that the tree will probably succeed well in regularly-irrigated districts, even if the atmosphere be dry and dusty. The temperature in the woods of the isthmus ranged from 75° to 88° Fahrenheit. Rain water, examined the moment it fell, was never found to be below 74°. The usual practice in collecting the milk was by felling the tree, and then making deep notches around the trunk at distances not exceeding one foot apart. Broad leaves were placed beneath these to receive the milk, which afterwards was collected in a large calabash or other vessel. A hole was then dug in the ground, and the milk poured into it and thatched over with leaves. It coagulated in about two weeks. Another method was to bruise a handful of the large broad heart-shaped leaves of a climber, a species of *ipomea*, and stir these about in the milk. By this operation the milk thickened in less than an hour, having the appearance of a jelly-like mass, but very porous, and exuding profusely a black ink-like water whenever touched or moved. This system of preparation produces an inferior article, and I have seen some buyers from the United States cut up the large juicy flakes into slices, an inch or so in thickness, and dry them in the sun. The temperature of the sea-water along the west coast, where the rubber tree grows, is high, and does not vary much during the year. In the Gulf of Guayaquil it is usually 78°, at Buenaventura 80°, and in the Bay of Panama 79°. The water of the River Chagres, although 80° in fine weather, falls during violent rains to 76°. On such occasions many fish are to be

seen in certain places floating about in the water benumbed-like or dying. I do not know if this is the result of the sudden lowering of the temperature, or if it is to be attributed to the great quantity of decayed vegetable matter brought down by the discoloured swollen torrents from the interior of the forests.

In India there are many districts which possess all the climatic conditions necessary for the successful cultivation of Central American rubber. From Bombay southward the majority of the deep debouches of the ghauts coming from the base of the western slope of the Malabar hills, including the humid forest region extending in places down towards the coast, contain many excellent sites. In Ceylon and Southern Burma and the Malay Peninsula, the tree is likely to thrive in all proper situations. Calicut is about in the same latitude as the centre of the region occupied by this rubber tree in its wild state. The deep recesses of the Sispara Ghaut really closely resemble some of the caoutchouc districts adjoining the River Dagua. The sites selected ought to be at low elevations, and no place should be tried where the temperature at any time during the year falls below 60° Fahrenheit. Marsh land must be avoided. In dry desert localities the tree may be expected to do well when planted along the banks of canals, or any description of channels where water is flowing for the whole or a portion of the day. Trees in good situations will produce seeds early, but these will require to be planted without delay, as drying destroys their vitality. But cuttings must be resorted to first, and stout branches, cut into pieces each possessing a bud, and covered lightly with soil, will generally be found to grow. Strong cuttings, a foot in length and furnished with buds, when planted in the usual way, will become strong plants sooner. However, the propagation of this tree will not be found so easy as the Ceara rubber.

In the planting out of young plants, the petiole or leaf stalk of the lowest or oldest leaf should be buried in the soil. By following this simple rule the plant commences to grow at once, its growth is vigorous and the trunk symmetrical.

But if at the period of planting there is much bare stem above ground, then growth is usually slow, the plant remains "leggy" for some time afterwards, and never makes a good tree. If the plants get a little attention until they are four or five feet in height, I do not think there is any description of weeds or forest growth in India that will afterwards overtop them. The rapid growth of this tree, by which a large amount of vegetable mould is added to the soil, is an important feature. My own opinion is, that if planted in suitable places and properly wrought, it will be found to yield a larger return per acre than any other plant or tree cultivated in India.

Concluding remarks.—In commencing the cultivation of these trees in India, it may be well to ascertain by actual experiment, as early as possible, the species likely to yield the largest amount of caoutchouc. It is possible that as regards quality there may be little, if any, difference in the milk of the various kinds when collected and prepared in the same way.

As has been already stated, each of the three sorts require rather different sites, a wet or swamp situation being most natural to the Para tree, while the moist banks of rippling streams or rivulets will be found well suited for the species from Panama. The Ceara tree is not delicate, and will grow and produce rubber in situations where oth er kinds if planted would be dried up. For these reasons, it is likely to prove a valuable plant in India in parched-up regions and stony unproductive lands thinly covered with soil. The cup method, if employed in an extended way, may be found a convenient mode of tapping. Thus 20 rows of cups distributed over the entire trunk might be put on at one time. The earth could also be cleared away from underneath the large roots to allow of their being properly tapped. Even by the rude method adopted in South America, by which the wood is much hacked, the roots are found to yield milk abundantly at all seasons of excellent quality. But whatever method is adopted, it is evident that if care is exercised tapping may be carried on continually. The Para tree in many localities gets no rest, except during a very "wet moon," or when the collectors are

drinking *cachass*. Therefore, the idea of giving the trees one or two years' rest ought not to be entertained. The Ceara method of paring off the surface of the bark might be tried on any of the sorts in dry weather. Para and Panama trees may be tapped on attaining a diameter of say 6 or 8 inches, and that of Ceara with a diameter of 4 to 5 inches. A collector in a plantation working with cups should be able to collect easily from 8 to 10 pounds of rubber per day. On the Amazon, in newly-opened districts, where the trees have not been operated on before, practised hands are sometimes able to collect from 20 to 30 pounds daily. A much greater quantity may be collected in even a shorter time on the Isthmus of Panama and adjacent regions, but then the trees are cut down to obtain the milk—a plan which it is assumed will not be followed in India. The cup process of tapping, the most general in use in the Amazon valley, is an Indian method, and is said to have been in use amongst them at the time America was discovered.

No time should be lost in reducing the milk, when collected, to a solid state, for if this matter is delayed, decomposition takes place, which furnishes much of the impurity complained of by manufacturers. If possible, the milk should be coagulated on the day it is collected. The milk of some species, such as that of the Panama rubber tree, may keep for a week or more in a cool shady place, but Para rubber milk spoils within the space of twenty hours, and gives off a most disagreeable odour. All the Para rubber is prepared by the smoking method I have described. Where nuts cannot be easily found green foliage is used instead. The "fumes of sulphur," "ammonia," or "acetic acid" are never employed. Alum is generally used in thickening the "mangaba" milk in the south of Brazil, but it appears to destroy the elasticity of the rubber. The watery portion may be evaporated by placing the milk, in small quantities at a time, in shallow vessels attached to any simple form of hot-water apparatus. Either this or the adoption of a smoking method similar to that of Para will probably be found the best. The material should be prepared in thin flakes about 1½ inches in thickness.

Those pieces, if made square in the form of a bale, could be fastened together and covered with coarse cloth. In this way rubber would be both easily handled and stowed.

The milk of *Masseranduba* (*Lucuma procera*), and of one or two milk-yielding trees of the Amazon districts reported to be mixed frequently with Para rubber, possesses no elasticity when prepared separately.

The island of Borneo has been suggested to me as a place specially suited for the formation of India-rubber plantations. No doubt they would grow there as well as in India, but probably not any better. Although the position in point of latitude may appear in favour of Borneo as regards the Para tree, I doubt if the climatic conditions of that island excel in any particular the southern portion of the Madras Presidency at low elevations. It must be remembered that what is termed by some the "equator of heat" is considerably to the north of our geographical equator. On the American continent it may, I think, be placed at not less than ten degrees of north latitude. In the dense forest regions of the Amazon and Panama Isthmus, the most striking feature is the extraordinary development of certain trees, occupying large spaces of ground, chiefly *ficus* and *bombax*, mantled by a dense profusion of leafy climbers, the trunks and branches clothed with parasitical plants. In India, as for instance, in the best forest portions of the Sispara Ghaut, there are no conspicuous large trees with buttressed roots, but there is a far more even development of general forest trees, and I have no doubt if an acre of such land was cleared, and the wood thereof weighed, it would be found to equal, if not exceed, the product of a similar extent of ground in the wooded districts of tropical America. Apart, however, there remains a more positive proof of the capabilities possessed by the climate of Southern India. The cocoanut and mango trees can only be cultivated in the hottest regions of the tropics. Now I have visited places where these trees were planted by the natives, such as Jamaica, Hayti, St. Domingo, Porto Rico, Santa Martha, Carthagena, Panama,

Buenaventura, Jumaco, Bahia, Esmeraldas, Guayaquil, and Para, but nowhere was the fruit superior, nor hardly so large as the mangoes or the cocoanuts of the Malabar coast. For these and other reasons I have confidence that there exist the necessary conditions for the successful cultivation of the American rubber yielding trees in many parts of India.

In conclusion, I trust the way in which I have performed these services may be considered satisfactory.

I am, SIR,
Your most obedient Servant,
ROBERT CROSS.

Ficus elastica in Arakan.

No. 19.

TO THE COMMISSIONER OF ARAKAN.

Dated Arakan Hill Tracts, May 23rd, 1878.

SIR,—Referring to your Docket marginally noted, received only on the 15th instant, I have the honor to report, for the information of Government, that the rubber which has this dry season been brought down for the first time to our Northern Frontier by Clans of the little known "Shandoo" or "Poor" race is alleged by them to be received in barter from the "Looshais;" but as these Shandoo Clans are of the wildest and most suspicious character, it has been undesirable to press them too closely on the point of the locality from which they obtain the same, as several had never before seen a European, neither visited us.

No. $\frac{511}{138}$ of the 24th ultimo.

2. If too much eagerness is evinced on the subject, on first introduction to our new guests, they will leave with the impression that, if we learn the source of the product, Government may occupy their country, and hence the information, meagre as it is, elicited from them on the point, in course of casual conversation (for direct queries are out of the question), has to be received "quantum valeat."

3. The Tribes who have recently brought down the trade mostly reside to the south and north of the "Blue Mountain,"* and some in territory, a large portion of which is unsurveyed and undefined.

For position, *vide* O'Donel's map, published by Government of Akyab District.

4. My own impression is that the *Ficus elastica* is indigenous to the above tract of country, and that the theory of their obtaining the same from the Looshais is a blind, because—

1*st.*—The natural outlet of the rubber trade from the Looshai country is "Demigiri," in the Chittagong Hill Tracts;

2*nd.*—The relationship of the above referred to "Shandoo" tribes with the "Looshais" is the reverse generally of that intimate and friendly kind which would allow of their obtaining it, when the Looshais have had for some years a good mart for it in the Chittagong Hill Tracts.

3*rd.*—Indirect information supplied me points to the fact that the *Ficus elastica* is to a limited extent indigenous to the tract of country about half a degree south of the Blue Mountain.

5. I trust next season to have time to learn more of, and improve our relationship with, these independent tribes, who mostly bring this article down, and heretofore only known to the Government as inveterate marauders on British Territory. I shall then be in a position to afford more definite information on the subject. Doubtless if the Arakan Hills is the *natural outlet*, and not the adjoining frontier of Chittagong, as also if our border remains *quiet*, a trade in this new industry will be established. It may be observed here, as pertinent to the question, that when on duty at Chittagong in September last I ascertained that for the last two years there had been a marked decrease in the amount of rubber exported from the Hill Tracts. An explanation on this point is deserving of attention.

From Deputy Commissioner, Chittagong Hill Tracts.

I have, &c.,
W. G. HUGHES, *Captain,*
Supdt. of A. Hill Tracts.

* The "Blue Mountain" is in latitude 22° 30," N.

Introduction of Rubber Plants into India.

From Her Majesty's Secretary of State for India, to the Government of India,—No. 18, *dated the 9th May* 1878.

On receipt of Your Excellency's letter No. 11 of the 22nd February last, relative to the distribution in India of the plants of the Copaiba Balsam, and of the Hevea, Ceara, and Castilloa rubber plants, a copy of it was forwarded to Sir Joseph Hooker, with a request that the wishes of your Government in this respect might be attended to.

2. I now transmit, for your information, copy of the reply* received from Sir Joseph Hooker, which contains a review of the operations undertaken at the Royal Gardens, Kew, in effecting the introduction of India-rubber plants into India.

* Dated 17th April 1878.

From—W. T. Thiselton Dyer, Esq., *Assistant Director, Royal Gardens, Kew, to the Under Secretary of State for India,—Dated 17th April* 1878.

I am desired by Sir Joseph Hooker to acknowledge the receipt of your letter of the 6th April, transmitting an extract from a letter from the Government of India, and requesting the transmission to Ceylon of certain stocks of Heveas and Castilloas.

In replying to this letter, Sir Joseph Hooker thinks it will be convenient that I should review the whole operations of this establishment in effecting the introduction of India-rubber plants into India.

1. *Hevea braziliensis* (Para rubber).—On 4th June 1873, we received from Mr. Markham some hundreds of seeds obtained from Mr. James Collins. Of these seeds less than a dozen germinated, and six of the plants so obtained were taken out by Dr. King, Superintendent of the Botanical Gardens, Calcutta, in the same year to India.

The climate of Calcutta did not prove very favorable to the Heveas, which require the conditions of growth met with in hot and moist tropical forests. It was, therefore, decided in

consultation with Mr. Markham that, in the event of more Heveas being raised and sent out from Kew, they should be received at the Botanical Gardens in Ceylon, which should then be regarded as the depôt for supplying young plants to such parts of India as were found to be suitable for its growth.

On June 14th, 1876, we received from Mr. Wickham about 70,000 seeds, of which about 4 per cent. germinated.

On August 9th we despatched 1,919 plants raised from these seeds to Ceylon in 38 Wardian cases, in charge of a gardener. Of the whole consignment 90 per cent. reached Dr. Thwaites in excellent condition. All subsequent accounts have been satisfactory, and no difficulty is found in multiplying the plants by propagation to any extent.

On August 11th, 50 plants were sent to the Botanical Garden at Singapore. Owing to the delay in the payment of the freight these plants all perished.

On August 23rd, 50 plants were sent direct to Major Seaton in Burma. These reached their destination in bad condition.

On September 29th a further supply of 100 plants was taken out to Dr. Thwaites, in charge of Mr. Duthie, Superintendent of the Botanical Garden, Saharunpur. These reached Ceylon in good order.

On June 11th, 1877, 22 plants were sent to the Botanical Garden, Singapore. The Superintendent reports that the climate appears suited to their growth.

On September 7th, 37 plants were sent to the Botanical Gardens in Mauritius, and reached their destination in good order.

On September 15th, 100 plants were again sent to Dr. Thwaites, and 50 to Calcutta, in charge of Mr. Morris, Dr. Thwaites's Assistant. Both consignment reached their destinations safely. Of those sent to Calcutta a portion was immediately despatched by Dr. King to Major Seaton, with whom they are now doing well.

It appears, therefore, that while upwards of 2,000 plants are safely established in Ceylon, smaller parcels are also growing in Burma, Calcutta, Mauritius, and Singapore. The plant is

now therefore to be regarded as definitely established in the East Indies, and with ordinary horticultural skill there should be no difficulty, in the course of a few years, in raising an indefinite number of young plants.

Beyond keeping a small stock for occasional distribution, it does not appear that this establishment is called upon to take any further steps for the propagation and distribution of this plant to India.

I should add that, on November 21st, 1876, Mr. Cross reached Kew with about 1,000 young plants brought direct from South America. Only about 3 per cent. of these plants survived, and they therefore contributed but little to our resources for distribution.

2. *Castilloa elastica* (Rubber of Central America.)—Sir Joseph Hooker has already stated, in a letter to the India Office, dated April 1st last, what has been done with respect to this kind. I quote the following passage :—

"The cuttings brought home by Mr. Cross were received on October 3rd, 1875. [The seeds (7,000) received previously failed to germinate.] Steps were immediately taken to establish and propagate them, and on August 9th, 1876, 32 healthy plants were forwarded to Dr. Thwaites, 28 of which he subsequently reported were well established in Ceylon and doing well.

"On September 15th, 1877, a further consignment of 24 plants was transmitted to Dr. Thwaites, in charge of Mr. Morris."

A few plants have also been sent to Mauritius and Singapore.

The propagation of this species will, for the present, be continued at Kew, and during the ensuing summer a further small consignment will be sent to Ceylon. Cuttings do not strike so readily as those of the Hevea, and the multiplication of plants is therefore necessarily slower.

3. *Manihot glaziovii* (Ceara rubber.)—Mr. Cross brought to Kew on November 21st, 1876, seeds and cuttings of this plant, from which a stock of 55 individuals was eventually obtained.

On June 11th of last year, four plants were sent to Singapore, and on September 15th, at which date our stock had increased to 300 plants of all sizes, 50 were sent to Dr. King at Calcutta, and 50 to Dr. Thwaites in Ceylon, both in charge of Mr. Morris. All the stems collected by Mr. Cross were divided between these two recipients. At the end of the year our stock amounted to about 450 plants. There will be no difficulty, therefore, in sending a supply of plants of this species to the Conservator of Forests in Madras in accordance with the wish of the Government of India. It will, however, probably be most convenient to treat Calcutta as the depôt for the Ceara rubber plants, as Ceylon must be for Heveas and Castilloas.

With respect to plants of the Copaiba Balsam, nothing can be done. From the five seeds brought to Kew by Mr. Cross, November 21st, 1876, only two plants have been raised, and these grow with excessive slowness. Nothing can therefore be done at present in propagating them.

Recapitulating, I have therefore to state that Sir Joseph Hooker is of opinion—

1. That it is unnecessary to transmit any more Hevea plants to India, and that application should be made for them to Ceylon when required for experimental cultivation.
2. That as the stock of Castilloas at Kew increases, further consignments should continue for the present to be made to Ceylon.
3. That plants of the Ceara rubber may with advantage be forwarded to Madras, but that the principal stock of young plants should be sent to Calcutta, from which they can be distributed.
4. That for the present nothing can be done, as far as Kew is concerned, with the Balsam of Copaiba.

From the Government of India, to Her Majesty's Secretary of State for India,—No. 23, *dated the* 1*st July* 1878.

We have the honor to acknowledge the receipt of your Lordship's despatch No. 18, dated the 9th May last, forwarding

copy of a letter from the Assistant Director of the Royal Gardens at Kew, which contains a review of the operations undertaken at those gardens for introducing the American rubber trees into this country, and, in reply, to express our concurrence in the proposals made therein, *viz*:—

That no more plants of the *Hevea braziliensis* need at present be sent to India or Ceylon;

That plants of *Castilloa elastica* should continue to be sent to Ceylon; and that the Botanical Garden at Calcutta should be made the depôt for the plants of the *Ceara* caoutchouc.

2. We would beg your Lordship to convey our acknowledgments to Sir J. Hooker for the services rendered by him in connection with the rearing and despatch of these rubber plants to India.

3. With regard to the origin of the arrangements for the cultivation of the rubber tree in Ceylon, we have the honor to state that in July 1875, Dr. King, the Superintendent of the Botanical Garden, Calcutta, reported that the plants brought out by him from Kew in 1873, had not done well at the Garden, and that he feared the tree would not find a congenial home in any part of Northern India. He suggested that it would probably thrive in Ceylon; and it was accordingly arranged, in communication with the Government of Ceylon, to use the Botanical Gardens there as a depôt for supplying rubber plants to British Burma and other parts of India.

Timber Trade in Assam.

THE principal sources of demand for timber in Assam are for the following purposes:—

Boat-building and dugouts, construction of houses and bridges, making charcoal, and for local use by the inhabitants, fire-wood, troughs for cattle, rice mills for husking rice, wooden seats, ploughs, and yokes for cattle, cart-wheels, and sugar-crushing mills.

The better class of furniture is almost all imported from Calcutta and Dacca, although excellent woods for this purpose are found in Assam.

Paddles for dugouts are largely made in Upper Assam of Bola wood, *Morus lævigata.*

Boat-building, as the largest industry, first claims our attention. The boats are built with smooth sides, not in clinker fashion, and are of burdens up to 1,000 maunds. They are largely employed in the carrying trade on the rivers in the province, and the demand for timber for their construction exceeds the supply, and is likely to enhance considerably the prices of the better classes of timber. The timber used in this industry is principally Sal, Sama (*Artocarpus chaplasha*), Jarul or Ajhar (*Largerstræmia regina*), and rarely Tittasappa (*Michelia champaca*) being also employed.

Other woods might certainly be used with advantage, but are not at present known in the trade. In Assam, Sal is almost confined to the districts of Goalpara, Kamrup, and the Garo Hills; the few blocks of Sal forest in Nowgong and Darrang being of inconsiderable area, and none at all existing in the districts further up the valley of the Brahmaputra.

From the earliest times on record the trade in Sal and Sama appears to have existed, nearly all the timber sold being brought down to sand churs at the mouths of the affluents of the Brahmaputra, at the end of the rainy season.

Hundreds of thousands of logs were annually sold at these timber markets, to merchants from Lower Bengal; and boats manned by Bengalis, and by Marawabadis who speak Hindi, and bring down from the Ganges boats built clinker shape of Badri timber, are used to float the logs to their destination at rates from Re. 1-8 to Rs. 2-8 per pair of logs according to the demand.

Latterly, wholesale destruction of timber by cotton jhuming and felling immature trees has so ruined the forests that the supply of timber suitable for boat-building is yearly becoming scarcer, and the quality fast deteriorating.

For cotton jhuming Sal forest is preferred, as young Sal trees are easily felled, and there is little or no undergrowth to clear away. I visited last year a cotton jhume in a zemindari forest, near Dhubri, and think that a description of it might not be inopportune.

An area of four or five acres of dense young Sal forest had been cleared, every tree being felled; and the stems were cut into lengths, and used as palisades, six feet above the ground all round the jhume.

The branches had been burned before the cotton was sown. Sleeping changs, raised 10 or 12 feet above the ground, were the only habitations.

At the entrances to the jhume pit-falls of 6 feet in length and depth and 4 feet broad had been dug to catch wild buffaloes, or rhinosceros, or other intruders from the surrounding jungle.

The cotton was full of pea fowl, and I shot three whilst walking round near the palisades, as they flew over into the Sal forest outside.

On such jhumes only one crop of cotton is raised, so that the rate of destruction of the forests may be readily imagined.

The log used for boat-building is called the *Dham*, and should exceed 4½ feet in girth, and in length between 6 and 7 feet, and be entirely of heartwood.

At present the *Dhams* are of girths down to 2½ feet, and are merely rounded, still containing sapwood, and the wood is so bad that boats which, if built of heartwood, would last without repairs for twenty years, now require constant patching, and can be scarcely kept together for more than five or six years.

Sama dhums are scarce, and of larger dimensions than Sal. The wood is therefore better esteemed, and fetches rather higher rates, chiefly on account of the absence of sapwood, which in Sama is so bad as not to pass muster at any market.

Tittasappa is of equal rank with Sama, but even rarer.

Jarul dhums, though of large girth, frequently up to 8 feet, and without sapwood, are liable to split when exposed to the sun, when stacked for sale on the sand churs.

The rates obtained for Jarul are, therefore, less than for the other woods; although it is of excellent quality for boats, if not split, and for all work in-doors.

The logs are worked out in the cold season by Mechi wood-cutters, called banatis, under a Duffadar.

The latter advances money for food and implements, and pays royalty and other charges on the timber. After the sale, he takes half the price obtained, and pays the other half to his men. The royalties charged have been out of all proportion to the price obtained by the Duffadars, until quite recently, and many of these men have made considerable sums of money, though they still retain their simple habits, and mostly bury their cash in earthen pots.

One of them is said to have lent a sum of Rs. 30,000 to the Parbotjuar zemindar.

Previously to 1870, only Rs. 4-4 per axe was charged in the Government Forests, which has been calculated at less than 2 annas 8 pies per tree, at a time when Dhums were selling at Rs. 10 to 15 a pair.

The Government rate is now Rs. 10 a Sal tree, and Rs. 6 for other trees, except in the Garo Hills, where Re. 1 per log was charged for Sal and Sama in 1876-77, although as much as Rs. 19 a pair was obtained for the Dhums, by the Duffadars, as some fine Sal timber still exists in the Garo Hills.

In the zemindary forests of the Goalpara district, royalties of Rs. 13-4 to 40 per hundred logs are charged according to their dimensions, and a further sum of Rs. 6-4 per cent. of value of sales effected is paid by the Duffadar to the land-owner.

The royalty paid to the Butirs is still only Rs. 4 per axe, and Rs. 7 for each gang of wood-cutters, called a Bada.

But timber cutting is exposed to other perils besides attacks of tigers, and sudden risings of the mountain streams in Bhutan; and, owing to the constant fighting going on amongst the people, no banatis have gone up to the hills during the present year.

Besides the royalty on timber cut in their zemindaries, the owners of the sand churs, on which it is stacked for sale, charge a rent called tolljhat, now levied at 4 annas a log for every log stacked, whether cut in their own estates or elsewhere.

This right of charging tolljhat gave rise to considerable trouble; when it was wished to take up land for Government depôts at the different timber markets, the zemindars claimed compensation, amounting to 6 lacs of rupees, for three such plots of land. It has, however, been found possible to acquire the land without paying such extortionate demands.

The prices now realised for dhums of Sal, Sama, or Titta-sappa range from Rs. 5 to 20 a pair, and for those of Jarul from Rs. 5 to 6.

The dhums are always cut at the base of the tree and contain the best of the timber. Next in importance are the house-posts, of which the Gul is the best.

As in the private forest, scarcely any trees of sufficient girth, for even the wretched dhums of the present day, can be found; the house-posts are taking their place in the market.

They are all of Sal timber, and are classed as follows, the prices given being the average obtained in 1876:—

Name of Log.	*Length.*	*Price per 100 Logs.*
Gunis	10½ feet to 12 feet.	... Rs. 40.
Derhatis	12 „ to 14 „	... not known.
Guls	16½ „ to 19 „	... Rs. 275.
Dootis	19 „ to 21 „	... „ 150.
Gadams	24 „ to 30 „	... „ 300.
Bishatis	30 „ and over	... „ 325.

The *dhams* which appear last in the list are young trees with little or no heartwood, and are fastened transversely across the boats used for floating down the timber, which is suspended from them by jute ropes.

The various classes of house-posts are eagerly bought up for house-building in Lower Bengal; none of them exceed 3 feet in girth at centre, all timber over such a girth being cut into *dhams*.

The only large logs now removed from the forests are those worked out by the Forest Department, which are mostly sold for public purposes.

Owing to the scarcity of labor in Assam, and to the convenience of getting timber ready sawn up, teak scantling, costing Rs. 2–8 per cubic foot landed at Dhubri, and at proportion

ately higher rates at stations further up stream, has been lately imported for local purposes, although Sal has been available in the rough at Re. 1-8 and at 1-4 per cubic foot, and is a better building wood than Teak.

The demand for dugouts is also very large, and boats of Sal, Sama, or Tittasappa, measuring 6 to 8 hands across the back, sell for Rs. 120 to 200 each. Such trees are getting rarer, and more inaccessible every year, and dugouts are now made out of softer woods, such as Gugera or Chelani, (*Schima mollis*,) and others, which only last a few years.

A statement prepared by Mr. Mann gives statistics of the consumption of tea boxes in Assam in 1875.

Leaving out Sylhet and Cachar which this article has not considered in treating of the timber trade of Assam Proper, or as it is now called the Assam Valley Districts, we find that 137,102 tea boxes were exported from Assam, and 135,718 imported; thus not more than 2,000 appear to have been made in the province.

Each box contains about a cubic foot o timber.

Most of the boxes come from Burma, and cost Re. 1-5 each in Calcutta.

Considering the large forests of soft wood trees in all parts of Assam, it is only the scarcity of the population which can account for such an import of wood into the province. In the Goalpara district there is a small population of Mechis who have been wood-cutters for generations; these men are already engaged in timber works in Government Forests, so that it is hoped that the anomaly of importing Burmese timber into al argely-wooded country will not continue long.

The quantity of charcoal used annually can be readily calculated from the quantity of tea exported, the exports in 1875 being about 12,340,000 lbs. The Government charge is for the right of making charcoal 2 annas a maund, but most of it is manufactured in private forests.

As to the articles for local use there are no statistics available; rough pieces of Bola wood for making paddles are sold for 8 annas to 12 annas each in the markets in Assam, and ploughs,

yokes, seats, rice mills, and rollers of Sal or Ahoy (*Vitea altissima*) are sold at the markets on the Dhubri and Kuch Behar road, at prices from 6 to 8 annas each. The people help themselves freely from the zemindary forests, and only expect to be compensated for the labour of cutting and bringing their goods to the market.

To facilitate their search for houseposts, fire wood, and wood for implements, they have been accustomed to fire the forests at the end of every cold season. As these practices are not allowed any longer in Government Forests, the cultivators talk of emigrating southwards from near the Forests in the Duars to the zemindary lands.

From the above remarks, it can be readily imagined that the Private Forests, though extending over several hundred square miles, will soon yield nothing at all.

Those in the Garo Hills, where there is no check to jhuming, seem to be destined to a similar fate in no short interval of time.

The imports of Burmese timber are not likely to increase, and have their origin more in the saving of labor than in the actual saving of expense.

Butir timber is very inaccessible, and the writer has reason to believe that Sál Forests in the Hills are not very extensive.

Government will soon be sole holder of all timber-yielding tracts in the Province, and the establishment of a general depôt at Dhubri, and the certainty of a supply there of all kinds of marketable timber will soon establish there the largest timber market in Eastern Bengal, and the introduction of steam machinery for sawing up scantling and tea boxes is mere matter of time.

W. R. F.

The Forest School at Dehra Doon.

THE following official papers will, no doubt, be perused by our readers with much interest. The want of a Forest School in India has been felt for some time, and we feel confident that the new institution will result in a great improvement of the subordinate staff, a subject which has received much attention from the officers of the Department.

1.—*Resolution of the Government of India.*

Under present arrangements, which have been in force since 1866, the training of superior officers for the service of the Government of India in the Forest Department is carried on at Nancy in France, and neither for these, nor for the inferior officers, is there any systematic training provided in India, except such experience as is gained in the performance of their duties.

It is evident that this system has its disadvantages. India is dependent on Europe for the training of its officers, while it possesses ample means of providing such training in its own forests, if a properly-organized system were set on foot. The Natives of India, whom it is extremely desirable to employ in all grades of the Forest Department, cannot, without a prolonged visit to Europe, obtain that systematic training which is necessary to render them competent to fill the superior offices, and for them, as well as for others, the establishment of a school in India for the scientific teaching of the principles and practice of forestry has long been looked upon by the Government of India as an object to be effected.

2. This question engaged the attention of the Government of India in 1869, when, with Circular No. 11F., dated the 28th July of that year, a report by the Inspector-General of Forests on the training of Natives for the superior appointments in the Forest Department was communicated to the local Governments and Administrations for an expression of their opinion. The result of the discussions which that report called forth was the appointment of a small number of Native apprentices, but no attempt was made to establish a Forest

School. The plan of establishing a separate institution for that purpose was first sketched by Sir Richard Temple when Lieutenant-Governor of Bengal, in a Minute dated the 9th October 1876, and it is in the direction indicated in that Minute that the Government of India now proposes to take action.

3. The Inspector-General of Forests has submitted a detailed report on the subject, suggesting that a Central Forest School be established in the North-Western Provinces. After consulting His Honor the Lieutenant-Governor of the North-Western Provinces on the subject of these proposals, the Governor-General in Council has decided to make a commencement at once. At first the school will be utilized for the training of officers for the executive branch of the service; it is hoped, however, that eventually, when a perfect system of management shall have been introduced in the forests attached to the school, it will be possible to advance a step further, and provide also for the professional education of candidates for the controlling branch of the service.

4. At the outset, the Forest School is only intended for the provinces under the Government of India, but should the Governments of Madras and Bombay desire it, arrangements will eventually be made to admit a limited number of students selected by the Conservators of Forests in those Presidencies.

In the provinces under the Government of India, the separation of the Controlling and Executive Staff is not yet complete, but, as a rule, executive charges are held by Junior Assistant Conservators, Sub-Assistant Conservators, Forest Rangers, and superior Foresters. The Forest School will at first only be used to educate candidates for the appointment of Foresters or Forest Rangers. None but Natives of India will be admitted as students, and successful candidates will, at the close of their education, obtain a certificate which will be called the Forest Ranger's certificate.

5. To attain these objects, it is necessary to set apart a number of forest districts in a central position under a separate Conservator to serve as model forest, and to be used for the instruction of the candidates. The Governor-General in

Council, accordingly, directs that the Forest Divisions of Dehra Doon and Jaunsar, situated in the Meerut Division of the North-Western Provinces, and comprising also the leased forests of the Native State of Garhwal, on the Tons and Jumna rivers, as well as a small portion of the forest leased from the Bashahr State, shall be placed under a separate Conservator of Forests, and attached to the Forest School. These forests present a great variety of vegetation, while such of them as are situated in the hills have an additional advantage in being composed of trees similar to those of Europe, so that a regular system of management can at once be established, based upon the long experience which has been gained in the forests of Europe.

6. The Conservator of the School Forests will also be Director of the Forest School; and Captain F. Bailey, R. E. the Superintendent of Forest Surveys, has been selected for the post. As a temporary measure, he will continue to hold the appointment of Superintendent of Forest Surveys in addition to the duties now assigned to him; but as, under this arrangement, he will no longer be able to give his time entirely to the work of the surveys, it has become necessary to strengthen the staff of officers under him to some extent, by attaching an additional Sub-Assistant Conservator to the Forest Survey Branch. The records of the Forest Survey Branch will be kept quite separate from those of the school and its forests, and the relations of the Superintendent of Forest Surveys to the Inspector-General of Forests, and to the Surveyor-General will remain unchanged. The Forest Survey Branch is at present engaged in making surveys of several important forest districts in the North-Western Provinces, and in accordance with previous orders on the subject, the Superintendent of Forest Surveys will conduct all work within the territories subject to His Honor the Lieutenant-Governor, under the control of the Government of the North-Western Provinces. Eventually, it may become necessary to separate the appointments of Superintendent of Forest Surveys and Conservator of the School Forests, but at present it is convenient to unite them in one officer. In his capacity as Conservator of Forests

and Director of the School, Captain Bailey will be entirely subordinate to the Government of the North-Western Provinces.

7. There will, therefore, as a temporary measure, be three Conservators of Forests in the North-Western Provinces and Oudh, whose charges may conveniently be designated as the Forest School Circle, the Central Circle, and the Oudh Circle. Experience must show whether, eventually, the two last-named charges may not conveniently be united. Until the organization of forest charges in the North-Western Provinces has been finally settled, the appointment of Deputy Conservator of Forests of the 1st Grade on Rs. 900 per mensem, now held by Captain Bailey, will be kept in abeyance, but in lieu of it an additional appointment of Conservator of Forests of the 4th class on a salary of Rs. 1,000 per mensem is sanctioned, and will be held by Captain Bailey.

8. The Governor-General in Council is of opinion that the selection of the candidates who may be sent to the Forest School to be trained, should be in the hands of the Conservators of Forests, who will act in this matter under such orders as may from time to time be issued by the local Governments and Administrations under whom they are serving. The suggestions contained in paragraph 45 of the Inspector-General's report regarding the qualifications that should be required from candidates are generally approved; but His Excellency in Council is of opinion that all candidates should possess a sufficient knowledge, either of Hindustani or of English.

It must be distinctly understood that Conservators should in no way be required to send to the school any Forest Apprentices if the means exist in their own province for giving them the necessary professional training. Should it, however, be considered desirable to send them, arrangements must be made for keeping appointments available for such candidates sent from the province as may succeed in obtaining a Ranger's certificate at the school.

9. Captain Bailey will assume charge of the forests assigned to the school on the 1st September next; but as it will not be possible by that date to organize the staff proposed to

be formed, and to complete all other necessary arrangements, it is not considered desirable that students should be received into the school before the 1st June 1879. Should, however, any local Government particularly desire that a few promising students should be sent to the school, Conservators may be directed to apply to the Director, who may, if arrangements are sufficiently advanced, as a special case, receive a few students during the current year.

10. Forest administration in India is not yet sufficiently established to justify the expectation that students will be willing to pay for the education which it is proposed to provide at the Forest School; on the contrary, it may in some cases be necessary to give advances of money to enable them to pursue their studies. Such advances may be granted under the authority of local Governments and Administrations, but due arrangements should be made for recovering the money so advanced. In order further to facilitate the studies at the school of any candidates who may be exceptionally promising, and who might otherwise be unable to attend, eight scholarships, at an aggregate outlay of Rs. 120 per mensem, will be sanctioned; and it will at the outset be the most convenient arrangement if local Governments and Administrations will communicate with the Inspector-General of Forests regarding the grant of scholarships to any candidates who may be specially deserving of such assistance. It is intended that eventually fees shall be charged for the instruction given at the school.

11. In paragraphs 49 to 62 of his report, Mr. Brandis has suggested the conditions and date for the admission of students, the course of studies to be pursued, and the expectations to be held out to those who obtain the Forest Ranger's certificate. These suggestions are generally approved, subject to such modifications as further experience may render necessary.

12. In order to secure efficient professional supervision over the working of the forests attached to the school, and the training of candidates, a Board of Inspection will be formed, consisting of the Inspector-General of Forests as President, and two members, one of whom will always be a Conservator

of Forests. Dr. Schlich, Conservator of Forests in Bengal, and Mr. J. S. Gamble, Assistant to the Inspector-General of Forests, are appointed members of the first Board of Inspection. The Governor-General in Council directs that the permission granted under paragraph 25 of the Forest Department Code to the Conservator of Forests in Bengal, to charge his *bonâ fide* travelling expenses, instead of the usual travelling allowances of a Conservator of Forests, shall be extended to the journeys he may make outside the limits of his province, on business connected with the Forest School under proper authority.

13. His Excellency in Council directs that the Inspector-General of Forests, as President of the Board, shall submit the reports and suggestions that may be recorded by it, or by any of its members, to the Government of the North-Western Provinces, with whom it will rest to pass orders thereon, or to submit them for the orders of the Government of India. On matters of professional detail and the training of candidates, the Conservator of the School Forests and Director of the School may, if the Government of the North-Western Provinces should see fit to do so, be permitted at any time to consult the Board of Inspection through its President.

The Government of India will from time to time, in communication with the Government of the North-Western Provinces and the Government of Bengal, arrange when the Board of Inspection shall assemble; the first meeting of the Board will be held in the autumn of 1878.

2.—*Extract from the Resolution of the Government of India.*

"It has been decided from the 1st September next to commence the organization of a Central Forest School in India, for the training of natives for the appointment of Rangers and superior Foresters; and for this purpose the forests in the Dehra Doon and Jaunsar divisions of the North-Western Provinces will be formed into a separate Conservatorship. In order to give effect to this measure, it is necessary to employ two competent trained officers in the forests which are to be attached to the Forest School, and His Excellency the Gover-

nor-General in Council has been pleased to select for this duty Messrs. Fisher and Smythies, Assistant Conservators of Forests, officiating in the 1st Grade in Assam and the Central Provinces, respectively."

3.—*Extract from a letter of the Government of India, to the Government of the North-Western Provinces.*

"The staff of superior officers and subordinate and office establishments at present employed in the three Forest Divisions proposed to be attached to the school, will be maintained, subject to such transfers as His Honor the Lieutenant-Governor may from time to time direct. It is, however, suggested that, if possible, Mr. O'Callaghan, Deputy Conservator of Forests, officiating in the 1st Grade, and Mr. Bagshawe, Deputy Conservator of the 3rd Grade, may be allowed to continue in the forests which are to be comprised in the School Circle, as their local knowledge and experience will be of great value to the new Conservator. In addition to the staff at present employed in these forests, it is proposed to post two professionally trained officers to the School Circle, in order to enable the Conservator to increase the number of Forest Divisions, and to provide for the theoretical instruction of the students. This will entail the addition of two officers to the superior staff sanctioned for the provinces under the Government of India; but until these appointments have received the sanction of Her Majesty's Secretary of State, to whom the matter will be referred, or until other arrangements can be made, the vacancies caused by the transfer of these officers from the provinces where they are at present employed, will be filled up by the appointment of two additional Sub-Assistant Conservators, who are accordingly sanctioned, as a temporary measure, in addition to the twelve officers of this class sanctioned in the Resolution of this Department, No. 30F., dated the 1st September 1877."

Memorandum by Dr. Brandis, on the Valuation Surveys lately made, and proposed to be made, in some of the Sal and Coniferous Forests of the North-Western Provinces.

At the request of Mr. G. Greig, Conservator of Forests, North-Western Provinces, I have recorded the following remarks and suggestions, which are the result of our discussions of this subject. Mr. Greig is my authority for the facts referred to in these remarks. My suggestions must be regarded as preliminary; they are intended to form the basis for further discussions on the subject of these valuation surveys.

2. Of the Sâl forests of the North-Western Provinces, those of the Mondhal and Nindhore Valleys are the ones most requiring valuation surveys; in fact, they are the only extensive forests in the North-Western Provinces which contain much mature Sâl timber.

The topographical survey of the Mondhal forest, on a scale of 4 inches=1 mile, has been completed, and the map will soon be available; but the survey of the Nindhore Valley has not yet been commenced.

3. Mr. Greig informs me that during the past winter Mr. Dansey has been employed in making a valuation of the Mondhal forests by counting all Sâl and Sein (*Terminalia tomentosa*) trees of 18″ circumference and upwards under the following classes:—

First class, in girth 6 feet and upwards, of which were counted 6,724 sound and 2,031 unsound Sâl trees.								
Second	„	„	between 4′-6″	and	6′,	of which were counted	15,804	Sâl trees.
Third	„	„	„ 3′	„	4′6,″	„	31,527	„
Fourth	„	„	„ 1′-6″	„	3′	„	45,287	„

4. The area accomplished during the season, on which the trees noted above were enumerated, is about five square miles, and the work was done by Mr. Dansey with the aid of four measurers during two-thirds of the time, and of seven measurers during the remainder. The work took from 5th December to 16th April, and occupied ninety working days.

Mr. Greig was not able to give me the area which he includes in the Mondhal range; but I am inclined to think that

it will be found to exceed twenty square miles, and it is obvious that steps must be taken to accelerate the progress of the work.

5. The forest in the Mondhal range is most irregularly stocked, and is situated in a broken hilly country, with sharp ridges and deep ravines, and no great extent of level ground anywhere. Under these circumstances, and considering the great value of the forests as a Sâl-producing tract, it would not be right to trust to sample areas, or linear valuation surveys, and the only plan which I can recommend in this case is to continue the enumeration of the trees of the four classes. When the results obtained by this valuation are used to frame a preliminary working plan, it must be borne in mind that the trees of the second class (4″ 6″ to 6″) are not always of younger age than the trees of the first class, but comprise a large proportion of old stunted trees. It will, therefore, be best to base the working upon the number of third and fourth class trees, and the time which these trees may be expected to require to attain first class size. This is mentioned in order to show that it would not be advisable to simplify the enumeration by limiting it to first and second class trees.

6. I recommend that the work be continued next season, and that its completion should, if possible, be entrusted to one and the same officer. But, in order to accelerate progress, I consider it essential that one Junior Assistant or Sub-Assistant Conservator, and a number of foresters or apprentices be placed under Mr. Dansey for this purpose. This arrangement will ensure the steady continuance of the work under all circumstances, and guard against its interruption by sickness or accident; but its chief advantage will be that, after a short time of working together in one party, Mr. Dansey will be able to form a number of parties working simultaneously in different compartments. When this organization has been effected, his duty will chiefly be to control and check the work of the different parties.

With a number of parties working under officers, who have been practically trained on the ground, and a competent superior officer at the head, who has himself conducted the

work of enumeration during one or several seasons, mistakes and careless work can readily be guarded against; for the controlling officer will, after the survey of any compartment is completed, be able to judge whether the figures obtained are accurate or not. In any doubtful case, he will do well to have the work in that compartment done over again by another party under his own supervision.

7. I would, therefore, strongly urge to attach to Mr. Dansey as strong a staff as circumstances will admit; the foresters and apprentices may be entertained temporarily; but as this work will be an excellent training school for them, they will probably afterwards readily obtain employment in the permanent establishment.

8. I understand that the forest, as far as the work has gone, has been divided into a number of compartments, bounded, as a rule, by natural features, and that the enumeration has been done compartment by compartment. The formation of compartments is, of course, the basis of the whole operation, and the selection of the compartment boundaries should always be made by the controlling officer himself; he must also draw up, after personal inspection, the detailed description of each compartment in the manner described in Section 79 of the Forest Department Code. I understand that this description has hitherto, in the North-Western Provinces, been drawn up in tabular form; this is inconvenient and objectionable; it causes waste of time and paper, and renders the documents unnecessarily bulky. The description must be drawn up in the form of a report under the prescribed headings, including past management, present condition, and proposals for future treatment.

It is, of course, necessary that the prescriptions of the Code, as regards designation of compartments, and all other matters connected with the preparation of preliminary working plans, be duly observed.

9. Simultaneously with the formation of compartments, their description, and the enumeration of the growing stock, endeavours must be made to collect data regarding the rate of growth of the Sâl tree. As there are no trees of known

age in the Mondhal range, the annual rings of stumps must be counted. Only a few trees have been felled in the Mondhal forest, but it will serve the purpose if the rings are counted on stumps in adjacent forests. Considerable progress has been made in determining the age of Sâl trees in the Eastern Duars of Assam by Mr. Fisher, and the plan pursued by him should be tried.

It would be premature now to say anything regarding the working plan to be based on this survey; that must be left until all data have been collected.

10. The valuation of the Nindhore forest range should be deferred until a detailed topographical survey has been made; by that time the valuation of the Mondhal will probably be completed, and the parties trained there may be transferred to the Nindhore valley.

11. Mr. Greig informs me that a different classification has been adopted for coniferous trees; the difference between the girth classes being 2′, as follows :—

First Class 16′ and upwards.
Second „ 14′ to 16′ „
&c., &c.
Seventh „ 4′ to 6′ „
Eighth „ 2′ to 4′ „

The difference between the classes has, I am told, been fixed at 2′ on account of the more rapid growth of coniferous trees, and the number of the higher classes has been increased, because the cubic contents of trees of large growth are very considerable.

12. Deodar and chír are not usually felled under 6′ in girth, and are not likely to be felled of a smaller size; it should also be remembered that in coniferous forests, old stunted trees of small girth are comparatively rare. Under these circumstances, it is for consideration whether the work might not be simplified by making 3′ the difference between the classes, and it would then suffice to have four classes only; above 12′ being the first, 9′ to 12′ the second, and 3′ to 6′ the fourth class. The greater or less abundance of poles, *i.e.*, under 3′ in girth, would then be stated in the detailed description of compartments.

13. Mr. Greig tells me that it is proposed to make a valuation of the Deota forest on a plan different from that above sketched, as adopted in the Mondhal, the difference being that it will not be made by the superior officer himself, but by a Munshi under his orders, whose work is to be checked by a second party going over the same compartment and recording the enumeration, without writing, by means of pieces of paper of different patterns. I do not believe in the efficacy of mechanical check under the circumstances of the case, and would strongly advise that no enumeration be attempted unless conducted on the plan adopted for the Mondhal forest as stated above. This remark also applies to the valuation of the Bhagirathi forest, which the Conservator informs me will be commenced this season by Mr. O. Greig.

14. As regards the Bhagirathi forest, the difficulty is that no detailed map is available. Under these circumstances, I advise that the Superintendent of Forest Surveys be requested to obtain, as soon as possible, a large skeleton map of 1 inch =1 mile, prepared from the data of the original survey, which doubtless are available in the Surveyor General's Office. This map should be similar to the one appended to the Bashahr Forest Report of 1864, the skeleton of which was furnished to me from the Surveyor General's Office.

15. The officer entrusted with the work should, under the instructions of the Superintendent of Forest Surveys, complete the skeleton map by sketching in the needful additional topographical detail, and he should pay particular attention to the correct entry of local names of streams, rocks, caves, mountains, courses of avalanches, and landslips, and other features. He should also sketch in the existing vegetation, and should enter approximately the limits of all blocks and compartments which he may form.

16. In the absence of a correct detailed map, no attempt can, of course, be made to determine the areas of blocks and compartments, and the chief work to be done in the Bhagirathi forest will be to enumerate the trees of the different classes and to prepare a detailed description of each compartment. This part of the work should be done in the manner

described above, for sample areas and linear surveys will be as little useful here as in the Mondhal valley.

17. The officer should commence, as Mr. Dansey has done in the Mondhal, by conducting the work himself in a number of compartments; and, after he has trained some of his subordinates so far as to work independently, additional parties may gradually be formed. The work of forming compartments and preparing the detailed description must be done by the officer himself.

18. He should devote special attention to the following points:—

1. Gradient of slope in the different portions of each compartment;
2. Average height of trees of the larger classes in the different parts of the forest;
3. Localities where the forest has been damaged by fire, and the effect of those fires;
4. Presence or absence of seedlings of deodar or other trees.

The determination of the rate of growth, by counting the rings, must, in these forests, be made in detail for each compartment, for it will be found to differ considerably in different portions of the forest and at different elevations. The officer should be furnished with a copy of the Bashahr Deodar Forest Report of 1864, and should pay special attention to paragraphs 15 to 19.

The Budget Estimate of the Forest Department for 1878-79.

RESOLUTION.—It has during late years been the practice to include in the general review of the Budget Estimates of the Forest Department the figures of only the British provinces under the Government of India, and to exclude the figures of the forest estimates of Mysore and Berar, as well as those of the presidencies of Madras and Bombay, on which separate orders have generally been passed. In the present and in future reviews, the practice which existed until 1871-72 will again be reverted to, and the whole of the figures will be brought together, in order to give a more complete idea of the financial position of the Forest Department throughout India.

2. It has also latterly been the custom to append to the general reviews of the Budget Estimates a tabular statement showing the amounts sanctioned by the Government of India under each head and sub-head of the estimates. This will now be discontinued, as it rests with local Governments to apportion the amounts sanctioned to the several sub-heads of each of the two main heads of "A, Conservancy and Works;" and "B, Establishments." Transfers of amounts from one main budget head to the other will continue to require the sanction of the Government of India, in accordance with the rule prescribed in paragraph 111 of the Forest Department Code.

3. The actuals of 1876-77, compared with the estimates, are as follows:—

PROVINCES.	Budget Estimate.	Regular Estimate.	Actuals.
Receipts.	Rs.	Rs.	Rs.
Bengal	2,40,000	2,30,000	2,22,401
North-Western Provinces and Oudh ...	13,82,000	11,47,000	11,50,671
Punjab	7,45,000	6,12,000	5,98,754
Central Provinces	7,00,000	7,20,000	6,61,326
British Burma	13,00,000	16,50,000	15,51,468
Coorg	66,500	76,500	75,929
Assam	1,10,000	70,000	81,568
Ajmere	500	500	905
Surveys	.....	.....	.....
Total ...	45,44,000	45,06,000	43,43,022
Madras	5,12,000	4,35,000	4.15,312
Bombay	12,26,000	11,78,557	12,26,658
Total of British Provinces ...	62,82,000	61,19,557	59,84.992
Mysore	4,22,000	4,30,000	4,66,956
Hyderabad	2,74,000	2,50,000	2,53,136
TOTAL RECEIPTS ...	69,78,000	67,99.557	67,05,084
Charges—A, Conservancy and Works.			
Bengal	97,000	70,000	90,172
North-Western Provinces and Oudh ...	7,25,000	6,45,500	6,50,000
Punjab	3,67,000	2,80,000	2 70,330
Central Provinces	1,94,000	1,85,000	1,67,334
British Burma	5,39,000	7,60,000	8,22,064
Coorg	23,500	23,000	18,493
Assam	42,000	40,000	42,005
Ajmere	12,000	12,000	11,433
Surveys	12,140	8,000	7,684
Total ...	20,11,640	20,23,500	20,79,515
Madras	2,64,000	2,22,000	1,94,943
Bombay	5,08,000	5 43,640	5,30,394
Total of British Provinces ...	27,83,640	27,89,140	28,04,852
Mysore	1,30,000	1,30,000	1,00,761
Hyderabad	57,000	50,500	40,506
TOTAL A, CONSERVANCY AND WORKS ...	29,70,640	29,69,640	29,55,119

PROVINCES.	Budget Estimate.	Regular Estimate.	Actuals.
Charges—B, Establishments.	Rs.	Rs.	Rs.
Bengal	1,16,000	1,20,000	1,21,517
North-Western Provinces and Oudh ...	2,02,000	2,11,500	2 10,249
Punjab	2,53,000	2,55,000	2,52,153
Central Provinces	1,41,000	1,25,000	1 21,306
British Burma	2,08,000	1,90,000	1,82,980
Coorg	15,000	15,000	14,836
Assam	53,000	45,000	47,915
Ajmere	12,000	12,000	11,025
Surveys	55,360	52,000	49,820
Total ...	10,55,360	10,25,500	10,11,801
Madras	2,10,000	2,23,000	2,19,027
Bombay	3,11,000	3,14,001	3,01,548
Total of British Provinces ...	15,76,360	15,62,501	15,32,376
Mysore	1,34,000	1,30,000	1,17,101
Hyderabad	55,000	55,000	54,146
TOTAL B, ESTABLISHMENTS ...	17,65,360	17,47,501	17,03,623
GRAND TOTAL OF CHARGES ...	47,36,000	47,17,141	46 58,742
Surplus ...	22,42,000	20,82,416	20,46,342

The receipts were originally over-estimated in the North-Western Provinces and Oudh, in the Punjab, the Central Provinces, and Assam: in Burmah, on the other hand, they have exceeded the original estimate. The expenditure has approximated closely to the estimates.

4. The above figures, compared with those of the two preceding years, show the following results:—

		1874-75.	1875-76.	1876-77.
		Rs.	Rs.	Rs.
Receipts	... ...	64,75,829	74,52,015	67,05,084
Charges	A, Conservancy and Works ...	30,16,158	27,79,206	29,55,119
	B, Establishments ...	14,75,015	15,56,575	17,03,623
	Total ...	44,91,173	43,35,781	46,58,742
	Surplus ...	19,84,656	31,16,234	20,46,342

5. In paragraph 4 of the Resolution No. 28F., dated the 23rd August 1877, reviewing the Budget Estimates of the Forest Department for 1877-78, it was explained that the large

surplus realized in 1875-76 was exceptional, and was chiefly due to the large timber sales effected at unusually high prices in British Burma, the Punjab, the Central Provinces, and Coorg. There is scarcely any appreciable difference between the surplus of the years 1874-75 and 1876-77, but in the latter year the causes which operated unfavourably to the department were, in *Bengal*, the cyclone which occurred in October 1876 and blocked up the streams in Chittagong, thus preventing the exportation of forest produce; in the *North-Western Provinces* and the *Punjab*, the failure to bring down sleepers and timber owing to the insufficiency of floods in the rivers; and in *Assam* to a recent decision of the Government of India, that the revenue derived from the elephant mehals and Soom forests should in future be credited to the head of "Land Revenue" and not to "Forests." In *British Burma*, the activity which prevailed in 1875-76, and resulted in the sale of large stocks of timber at unusually high prices, was succeeded by a depression in the timber market, which left large stocks of timber unsold in 1876-77. The famine in the *Madras Presidency* has caused a falling-off in the receipts of the Forest Department, and in the *Central Provinces* the temporary reduction of forest revenue in 1876-77 was caused by a sudden and unusual demand for carriage for the transport of grain to the famine districts, which rendered it impossible for traders to remove timber. It is satisfactory that neither in *Mysore* nor in the *Bombay Presidency* was the forest revenue of 1876-77 sensibly affected by the famine. In the former province high prices were realized by the sale of sandalwood, while in the Bombay presidency a considerable increase in the forest receipts of Sind was caused by the increased demand for steamer fuel in consequence of the development of the grain traffic down the river.

6. In reviewing the estimates for 1877-78, the expenditure of the department was exhibited under the two main heads of charges incurred for the production of revenue, and for the demarcation, improvement, and formation of the forests. The following allotment of the receipts and charges is suggested by the new classification of the sub-heads of the Budget Estimate now in force, and exhibits the same results, with the addition

of the financial transactions on account of timber brought to depôt and sold on account of Government:—

		1874-75.	1875-76.	1876-77.
Receipts.		Rs.	Rs.	Rs.
Revenue from timber and other produce removed on account of Government ...	I	32,46,393	44,53,150	36,41,866
Other revenue ...	II to V	32,29,436	29,98,865	30,63,218
Total ...		64,75,829	74,52,015	67,05,084
Charges.				
For timber and other produce removed on Government account	A I	20,16,697	16,86,026	18,85,523
For other revenue ...	II, III, IV	1,73,063	1,93,093	2,00,588
For formation, maintenance, and improvement of forests	V, VII, VIII	6,29,165	6,85,947	6,45,250
Charges on account of live and dead-stock, and miscellaneous	VI & IX	1,97,233	2,14,140	2,23,758
Establishments	B	14,75,015	15,56,575	17,03,623
Total ...		44,91,173	43,35,781	46,58,802

7. In 1876-77, the net result of the timber operations was a gross surplus of Rs. 17,56,343, but a true estimate of the financial transactions on this account can only be arrived at by reviewing the results of several years. Taking the aggregate of the receipts and charges for the last three years, the result is as follows:—

	Receipts.	Charges.
	Rs.	Rs.
1874-75	32,46,393	20,16,697
1875-76	44,53,150	16,86,026
1876-77	36,41,866	18,85,523
Total ...	1,13,41,409	55,88,246

This leaves a surplus of Rs. 57,53,163, or an average for each of the three years of Rs. 19,71,721. Against this should, however, be charged a proportion of the expenditure on account of live and dead-stock, and miscellaneous and establishment charges. In some provinces a quota of the charges for communications and buildings (A VII), which, in the above

statement, have all been allotted to the improvement of the forests, are debitable to the Government timber operations Circumstances are not alike in the different provinces, and a fixed proportion of these charges is not suitable to all provinces, but whatever the proportion to be debited against the Government timber operations may be, it is certain that the surplus will be reduced considerably. This is not the case with the revenue of the department derived from other sources, which shows a large surplus.

8. The amount expended on the demarcation, formation, and improvement of the forests is still proportionately small, and the Governor-General in Council desires again to urge upon all Governments more vigorous action in improving the area and productive powers of the State forests. Wherever practicable, the means for doing so must be provided by exercising greater economy in the expenditure on timber operations. Her Majesty's Secretary of State, in reviewing the orders of the Government of India on the forest budget of 1877-78, has lately expressed the following views regarding the financial results of forest administration in India :—

"The areas of forests at present reserved and demarcated throughout India bear but a small proportion to what, it is hoped, may eventually be taken up by the department, and as these areas are annually extended, it may be expected that the expenditure required for their conservancy will also increase. It is undoubtedly desirable that this increase of cost should be covered by receipts from the sale of forest produce, and under careful management this will no doubt be the case. At the same time it must be borne in mind that the present operations of the department are more with a view to the protection of forests from destruction, and the extension of their resources so as to meet the increased demands that may be expected to be made on them in the future, than for the purposes of present revenue. Some day, however, it may be hoped that the State forests will contribute, to no inconsiderable extent, to the resources of the empire."

9. The figures of the Regular Estimate for 1877-78, as compared with the Budget Estimate, are as follows :—

	Budget Estimate.	Regular Estimate.
Receipts.	Rs.	Rs.
Bengal	3,00,000	3,40,000
North-Western Provinces and Oudh ...	10,10,000	10,40,000
Punjab	7,30,000	6,30,000
Central Provinces	7,00,000	7,00,000
British Burma	12,50,000	15,61,000
Coorg	81,500	94,500
Assam	70,000	1,25,000
Ajmere	500	15,000
Surveys	.....	.....
Total ...	41,42,000	44,92,000
Madras	4,50,000	3,76,000
Bombay	13,60,000	12,93,000
Total of British Provinces ...	59,52,000	61,61,000
Mysore	4,24,000	4,65,000
Hyderabad	2,56,000	2,80,000
TOTAL RECEIPTS ...	66,32,000	69,06,000
Charges.		
Bengal	2,20,000	2,70,000
North-Western Provinces and Oudh ...	7,97,000	7 82,000
Punjab	5,90,000	5,52,000
Central Provinces	3,57,000	3,45,000
British Burma	8,32,000	10,11,000
Coorg	41,500	43,000
Assam	1,00,000	1,05,000
Ajmere	17,000	17,000
Surveys	67,500	60,000
Total ...	30,22,000	31,85,000
Madras	4,20,000	3,65,000
Bombay	9,73,000	8,81,000
Total of British Provinces ...	44,15,000	44,31,000
Mysore	2,53,000	2,22,000
Hyderabad	1,13,000	1,05,000
TOTAL CHARGES ...	47,81,000	47,58,000
Surplus ...	18,51,000	21,48,000

10. The figures of the Budget Estimate entered above for the provinces under the Government of India, as well as for the Presidencies of Madras and Bombay, differ from those sanctioned in Financial Resolution No. 1853, dated the 31st March 1877, circulated with the Resolution from this Depart-

ment, No. 28F., dated the 23rd August 1877, reviewing the estimates for 1877-78, thus,—

	Receipts.	Charges.
	Rs.	Rs.
As detailed above	59,52,000	44,15,000
As sanctioned in the Financial Resolution ...	57,92,000	41,49,000
Difference ...	1,60,000	2,66,000

This is owing to the additional grants sanctioned during the year, *viz.*, Rs. 1,60,000 for supplying sleepers to the Scindia State Railway from the forests of the North-Western Provinces, which will yield no return during the year, and Rs. 1,06,000 in round numbers for the Bombay Presidency, of which Rs. 81,000 was for Scind, to meet an increased demand for fuel, and Rs. 25,000 for working the Satpura forests in Khandesh. The expenditure for these purposes was expected to yield an additional revenue of Rs. 1,60,000 in round numbers.

11. Comparing the figures of the Budget Estimate with those of the Regular Estimate, it is observed that a decrease is expected in the receipts of the *Madras* and *Bombay* Presidencies, which is attributable to the drought and famine which prevailed. There is also a decrease of nearly a lakh of rupees in the *Punjab*, which is caused by the failure of floods in the rivers to bring down the timber which was expected. A large increase of receipts is expected in *British Burma* by the sale of timber and forest produce, which, it is hoped, will be realized; but the demand for, and the prices of, teak timber in that province are very fluctuating. Of the remainder of the increases, those in *Bengal*, *Oudh* and *Assam* are the result of steady improvement in the administration of the forests.

The charges are not materially altered, and call for no remarks.

12. The following statement exhibits the estimated receipts and charges for 1878-79 proposed by the several Governments and administrations, and those at first provisionally and now finally sanctioned by the Government of India:—

PROVINCES.	Proposed by local Governments.	Provisionally sanctioned by the Government of India.	Finally sanctioned by the Government of India.
Receipts.	Rs.	Rs.	Rs.
Bengal	3,42,000	3,42,000	3,42,000
North-Western Provinces and Oudh ...	14,20,000	14,20,000	14,20,000
Punjab	6,64,000	6,50,000	6,50,000
Central Provinces	7,96,000	7,96,000	7,96,000
British Burma	13,69,810	13,70,000	13,70,000
Assam	1,03,000	1,03,000	1,03,000
Coorg	80,000	80,000	80,000
Ajmere	610	600	.....
Surveys	.....	.....	.....
Total ...	47,75,410	47,61,600	47,61,000
Madras	4,34,000	4,34,000	4,34,000
Bombay	16,25,177	16,25,000	16,25,000
Total of British Provinces ...	68,34,587	68,20,600	68,20,000
Mysore	4,98,500	5,00,000	5,00,000
Hyderabad	2,58,000	2,58,000	2,58,000
TOTAL RECEIPTS ...	75,91,087	75,78,600	75,78,000
Charges—A, Conservancy and Works.			
Bengal	1,25,000	1,25,000	1,25,000
North-Western Provinces and Oudh .	6,63,770	6,63,070	6,63,070
Punjab	3,60,000	3,30 000	3,30,000
Central Provinces	2,40,000	2,40,000	2,40,000
British Burma	6,68,350	6,70,000	6,70,000
Assam	85,400	70,000	70,000
Coorg	22 200	22,000	23,000
Ajmere	5,431	5,500	5,500
Surveys	11,300	10,000	10,000
Total ...	21,81,451	21,35,570	21,36,570
Madras	1,86,500	1,86,000	1,86,000
Bombay	7,60,689	7,00,000	7,00,000
Total of British Provinces ...	31,28,640	30,21,570	30,22,570
Mysore	1,20,750	1,20,000	1,20,000
Hyderabad	55,000	55,000	55,000
TOTAL OF A, CONSERVANCY AND WORKS	33,04,390	31,96,570	31,97,570
Charges—" B, Establishments."			
Bengal	1,25,000	1,25,000	1,25,000
North-Western Provinces and Oudh ...	2,28,830	2,27,930	2,27,930
Punjab	2,80,000	2,64,000	2,64,000
Central Provinces	1,66,800	1,67,000	1,67,000
British Burma	2,66,726	2,48,000	2,48,000
Assam	75,600	68,000	68,000
Coorg	20,200	20,000	20,000
Ajmere	10,259	10,100	10,000
Surveys	59,100	57,500	57,500
Total ...	12,32,515	11,87,530	11,87,430
Madras	2,47,000	2,30,000	2,30,000
Bombay	3,25,760	3,25,000	3,20,000
Total of British Provinces ...	18,05,275	17,42,530	17,37,430
Mysore	1,26,250	1,20,000	1,20,000
Hyderabad	59 000	59,000	59,000
TOTAL B, ESTABLISHMENTS ...	19,90,525	19,21,530	19,16,430
GRAND TOTAL OF EXPENDITURE ...	52,04,915	51,18,100	51,14,000
Surplus ...	22,96,172	24,60,500	24,64,000

13. The following statement exhibits the receipts expected to be realized during the current year, side by side with the actuals of 1876-77 and the approximate figures of 1877-78 :—

	Actuals, 1876-77.	Regular Estimate, 1877-78.	Budget Estimate, 1878-79.
	Rs.	Rs.	Rs.
Bengal	2,22,401	3,40,000	3,42,000
North-Western Provinces and Oudh ...	11,50,671	10,40,000	14,20,000
Punjab	5,98,754	6,30,000	6 50,000
Central Provinces	6,61,326	7,00,000	7,96,000
British Burma	15,51,468	15,61,000	13,70,000
Coorg	75,929	94,500	80 000
Assam	81,568	1,25,000	1,03,000
Ajmere	905	1,500	....
Surveys	.....	.....	.....
Total ...	43,43,022	44,92,000	47,61,000
Madras	4,15 312	3,76,000	4,34,000
Bombay	12,26,658	12,93,000	16,25,000
Total of British Provinces ...	59,84,992	61,61 000	68,20,000
Mysore	4,66,956	4,65,000	5,00,000
Hyderabad	2,53,136	2,80,000	2,58,000
GRAND TOTAL ...	67,05,084	69,06,000	75,78,000

These figures show that a considerable increase is expected in the North-Western Provinces and Oudh, in the Punjab, in the Central Provinces, and in the Bombay Presidency, while British Burma shows a large decrease.

The increased receipts in the *North-Western Provinces* are due in a great measure to the expected sale of railway sleepers which the Forest Department is under engagement to supply, and for the preparation of which an additional grant was sanctioned in 1877-78. It is hoped that the estimated receipts in the *Punjab* will be realized, but the estimates of forest receipts in that province are open to considerable uncertainty owing to variations both in the occurrence of floods in the rivers and in the demand for timber. The receipts of the *Central Provinces* are rising steadily with rare fluctuations, and this is due to the large area of demarcated reserves in those provinces, and the excellent system of Forest administration which has now been firmly established there. In *British Burma*, the receipts have been estimated advisedly at

a low figure, but if the demand for, and the prices of, timber improve, it is hoped that the receipts will be equal to the realizations of 1876-77.

It is satisfactory to notice that in the *Presidency of Bombay*, which has suffered so much from famine, the forest receipts are expected to increase largely, and there is ground for believing that the estimated amounts will be realized.

14. The amount sanctioned under "Conservancy and Works," as compared with the actuals of the two previous years, is as follows :—

				Rs.
1875-76	...	...	...	27,79,206
1876-77	...	...	...	29,55,119
1878-79	...	...	...	31,97,570

The increase of these charges is necessary in order to keep pace with the gradual extension of the demarcated forest domains of the State. It rests with local Governments to apportion the amounts sanctioned to the different sub-heads, and the Governor-General in Council trusts that as large a proportion of these amounts as possible will be made available for the maintenance and improvement of the forests.

15. The amounts sanctioned for "Establishments" in 1878-79, as compared with the actuals for 1875-76 and 1876-77, are as follows :—

				Rs.
1875-76	...	...	...	15,56,575
1876-77	...	...	...	17,03,623
1878-79	...	...	...	19,16,430

Establishment charges must increase *pari passu* with the extension of demarcated State forests, but this branch of the expenditure requires close attention in detail by local Governments.

16. Paragraph 12 of the Resolution in this Department, No. 5, dated the 3rd February 1877, directed that the annual budget estimates of the Forest Department should be accompanied by—

(1.) A copy of the last sanctioned scale of establishments;

(2.) An explanatory note justifying the figures of the estimate and detailing the nature and cost of the different operations on which expenditure is proposed in the year for which the Budget Estimate provides.

Under the orders contained in the Circular Resolution from this Department, No. 28F, dated the 17th ultimo, sanctioning monthly maximum amounts for subordinate forest establishments, it will no longer be necessary to attach a copy of the last sanctioned scale of establishments to the budget estimates.

The explanatory note justifying the figures of the estimate will be submitted as usual, but it should be prepared with greater brevity than has hitherto been done. The documents received latterly with the estimates from several provinces have been extremely bulky. All statements that are not absolutely necessary should be omitted so as to render the papers less voluminous.

All figures, except those representing "Actuals," should invariably be entered in round numbers.

A Manual of Indian Sylviculture.

SIR,—As a foundation for all correct work in dealing with our forests, it is necessary that every Forest Officer should possess the latest and most certain information in relation to every tree with which he is brought into contact in his professional capacity. This is a truism; but how unsettled, how unsatisfactory is often the knowledge of even Divisional Officers on the subject of the most important among the trees constituting the forests under their care, and hence what faults in treatment, what a waste of time and of money through carrying out operations which the experience of others have already condemned! How often does it not happen that an officer is transferred to a province or to a part of the same province with the forest vegetation of which he is quite unacquainted, and the requirements of and specialities inherent in the various species composing which he can only learn

by long and patient observation, more especially in the case of an untrained Forest Officer whose mind is not drilled, and whose efforts are not directed by a perfect knowledge of the laws of forest growth.

Every year the department is recruited by a number of young men who are placed at a similar disadvantage. Many important operations are executed in our forests by men who, for the above reasons, are not competent to do them, and the forests, of course, suffer in consequence.

It is, therefore, imperative that we should have some standard guide to the cultural requirements of all our most important forest trees. Such a work would not obviate all necessity to learn for ourselves. But it would direct us in the right way and considerably shorten our period of incapacity.

It is true that our knowledge on the subject is very imperfect as yet, but in order to develop the information we do possess, it is necessary that we should know the present range of such information, however small. As we gain in experience we must build upon this structure. Without a foundation we cannot construct at all.

Dr. Brandis's Flora is a most valuable work, and very useful are the other Floras at our disposal; but, as a matter of course, such works do not aim at giving the very detailed information here required, the specialities from a cultural point of view attaching to the tree. The soils, climate, exposition, slope affected by it, its growth, longevity, usefulness as a timber or for other purposes, its enemies, method of propagation either naturally or artificially, &c., &c.

All this mass of detailed information, which is quite necessary to render the Forest Officer really efficient, exists in the shape of accurate data in the heads of the many only, and not in that of any one person, even in the case of one kind of tree. The facts are scattered here and there. The experience of one officer needs the confirmation of others. The tares have also to be eliminated from the wheat. A mass of evidence requires to be carefully sifted and then condensed.

We have, it cannot be doubted, a number of officers among

us who take a very great interest in their profession; and indeed Forestry is in itself so attractive a science, that we can assume that most of us are continually observing the phenomena attaching to the growth of the different species of trees and the results of natural or artificial changes in the mass of a forest. Many of us have exceptional experience in the artificial re-production of some species, &c., &c.

The Forest Department has now been working for many years, and a valuable fund of information of all kinds must therefore exist. It is true that it is much diffused, the knowlege is unequally distributed, being in the case of every one officer more or less indefinite and lacking a more general confirmation.

It is my proposition that this information, imperfect as it may be, be made use of to form a foundation for the more noble edifice which will necessarily follow upon a more extended experience in the future. Without such a foundation in the shape of a Manual of Sylviculture in the hands of every officer, any addition to our knowledge in the future must be very slow and often questionable, and hence a really sterling work on the subject almost impossible. We have not to deal here with a country like France or Germany with a dozen species of forest trees; pretty equally distributed over the whole country, but with a huge continent, where both climate and vegetation differ widely, rendering it possible for one man to gather a complete knowledge of but a small number of its forest trees during a lifetime.

It stands to reason that such a Manual could never be compiled from contributions invited for the purpose to the *Indian Forester*. In the first place, it would take an endless time; and in the second place, many observing officers would be too bashful to bring their ideas before the public, some from a want of confidence in their theories, others from a lack of faith in their grammar.

I would therefore suggest, in order to effect the purpose desired, that every Forest Officer who has, by a residence of two years or more in one district, familiarised himself with the forest vegetation of those parts, be bound to furnish his

Conservator, upon being called to do so, with a memo. containing his ideas on the subjects required of him.

All memos on the same subject would then be separately filed by the Conservator and sent on to some officer who, from his experience in India and his possession of other attributes necessary for the purpose, would be the fittest person to compare the intelligence before him, to sift it, to bring out in a compressed form all the useful information and matters of interest, and to add to the summary of each subject such data of a general nature as could not be expected from the contributors themselves, and thus gradually would the work be built up.

Forms might be served out containing the headings under which information would be required. This would prevent the discussion of superfluous matters on the part of the contributors and keep them from useless digressions.

Not least of the advantages of the plan here proposed would be a true insight into the real worth of the different Forest Officers, and a strong inducement to the indifferent to look about them more.

Yours faithfully,
FAGOT DE SAPIN.

1*st July* 1878.

The Catalpa and its Uses.

(*From the "American Agriculturist."*)

THE Catalpa (*C. bignonioides*) is likely to receive much more attention at the hands of tree planters than heretofore. It is essentially a southern and south-western species, finding its northern limit in Southern Illinois and Indiana, but cultivated much farther northward. In exposed situations in northern localities, the tree is not seen at its best; the head is often very irregular from injury in severe winters, or the breaking of the branches by violent storms, and when naked is anything but an elegant object. When the abundant leaves appear, these defor-

mities are hidden, and the whole aspect is changed. The long petioled leaves, either opposite, or three in a whorl, are large, heart-shaped, downy on the under side, and of a peculiar shade of green. The flowers appear in June and July in large open panicles, often a foot long, and are produced in such profusion that a specimen in full bloom is a most pleasing sight. The individual flowers are about an inch long, elongated bell-shaped, with a wavy 5-lobed border, and somewhat two-lipped; they are white, and generally tinged with violet, and spotted within with yellow and purple dots. The flower are succeeded by long, slender, cylindrical pods, often a foot or more long, which hang until spring, and are so conspicuous, especially after the leaves have fallen, that in some localities the tree is known as the "Indian Bean." The pod is divided lengthwise by a partition, forming two cells, which contain numerous very flat seeds, having on each side a wing, which is much cut, and appears like a fringe. Boys often amuse themselves with the pods as substitutes for cigars, the cottony wings to the seeds giving an abundant, and probably innocent, smoke. As an ornamental tree, the Catalpa, with many merits, has some faults. As already mentioned, its naked branches are unsightly, and the leaves are among the latest to appear, while they drop with the very first frosts. Its bark, when wounded or cut in the spring, is said to emit a very offensive odour. The honey collected from its flowers is said to be poisonous, though we have seen no direct evidence upon this point. The name, *Catalpa*, is supposed to be derived from the Indians; it was originally described by Walter as *C. bignonioides*, from the resemblance of its flowers to those of the *Bignonia* or Trumpet-creepers; later botanists have called it *C. cordifolia* and *C. syringæfolia*; but these, according to the rules, should give place to the older name. It belongs to the Bignonia Family. Our principal reason for briefly describing the Catalpa, is on account of its economic importance. In most works on trees, its timber is briefly mentioned as "lasting," though Mr. Arthur Bryant in his work gives more importance to this quality, stating that he is assured that posts "have stood for forty years without the appearance of decay," and

advises its cultivation "to a limited extent." Probably the earliest advocate of the Catalpa was General Harrison (afterwards President), who, in an agricultural address at Carthage, O., in 1825, advised farmers to cultivate it on account of its great durability for posts, &c. He, when Governor of what was then the North-West Territory, found Catalpa pickets in the old French stockade at Vincennes, which were yet sound, though they must have been in place for a century or more. Later, Dr. Warder and others have given testimony as to its value. Mr. E. E. Barney, of Dayton, Ohio, has, as mentioned last month, done excellent service in collecting the scattered testimony as to the value of the timber of the Catalpa, adding to it important notes of his own, and presenting the whole in a pamphlet. Mr. Barney calls attention to the fact, first pointed out by Doctor Haines, of Dayton, that there are two varieties of the Catalpa; one blooms two weeks earlier than the other, has larger flowers, which are nearly pure white, with larger, longer, and fewer seed pods. Mr. Suel Foster, a well-known horticulturist of Muscatine, Iowa, has also noticed this difference, and found the early-flowering form to endure a winter which killed the ordinary kind. He proposes to call this form "*the hardy*," and the later blooming "*the common*" Catalpa. Those who contemplate tree-planting will do well to procure the pamphlet referred to (which Mr. Barney generously supplies for two 3c. stamps), as we can here only briefly sum up the evidence there presented. The valuable qualities of the tree are: ease of propagation; adaptability to various soils; rapid growth; freedom, so far as known, from the attacks of insects, and the great value of its timber, especially as to durability when exposed to the weather, or in contact with the earth. As to climate, Mr. Foster thinks that the common kind cannot be depended upon north of St. Louis, while the variety just mentioned has endured the severest winters of Iowa and Illinois without the least injury. That a variety in the color of the flowers, leaves, or fruit of a plant is often accompanied by a difference in hardiness, and that some varieties are more hardy than the type, is well known to cultivators, and is by

no means peculiar to the Catalpa. The seeds are sown in spring in nursery rows, thinned to about a foot, and transplanted when one or two years old, as may be most convenient. In the plantation they are set four feet apart each way; close planting is necessary to insure a straight, clean trunk. In twelve years, each alternate row may be cut out for telegraph poles or fence-posts, and in about twelve years more the remaining trees, in good soil, will make six railroad ties each. Mr. Barney estimates that at the present prices, a plantation of Catalpa will make a return of $25 per acre for each year of the whole time that the trees occupy the ground. Those who have only seen isolated and scraggy specimens can have little idea of the Catalpa as a forest tree; in favourable localities it has reached a diameter of three and even four feet, with a clean trunk of 50 feet, without a branch. The trunk of this tree is preferred in the South-west for making dug-out canoes, as they neither crack nor decay. The great durability of the timber seems to be well established, and several instances are cited in which posts set in the ground, or logs laying upon it, have been exposed from 70 to 100 years without perceptible decay. The great demand for the timber will be for railroad ties; for this use it should resist the crushing effect of great weight, as well as decay, and should also be able to hold the spikes firmly; so far as tried, the Catalpa ties have proved, when tested side by side with ties of oak, perfectly satisfactory in these respects. One great advantage of the Catalpa over most other woods is the inappreciable amount of sap-wood, or "sap," as the immature, recently-formed outer layers of wood are popularly called. This, even in cedar and other trees, the heart-wood of which is durable, decays rapidly, but even small stakes of the Catalpa suffer no appreciable loss from this cause. Besides durability, Catalpa-wood possess beauty to a remarkable degree; its general color is a warm buff, the "silver grain" being straw-colored; it takes a fine polish, and is well suited to interior finishing and cabinet work. Mr. Barney, who is known at the West as "the Veteran Car-Builder," sends us specimens of the wood, cut in different directions, with one

surface polished; one of these is from the lower end of a bar-post that is known to have been in the ground for seventy-five years; and, though stained a little darker, is quite as sound as the others from trees cut last year. All present a beautiful polish.

II. Reviews.

The Journal of Forestry and Estates Management.

The number for April opens with some more remarks about a Forest School at Edinburgh, which will perhaps be read by those who are not sick of the subject, and who would like still to hear a little more nonsense talked about the state of India.

The notice about Dr. Hough's circulars to collect information about Forestry in the United States is worth reading; it will not be supposed that this exhausts Dr. Hough's enquiry, or that he does not think it necessary to enquire what areas still exist covered with natural forest, and what are the means of export from them.

There is a good article on Bark and Bark Stripping, which will be read with interest, although at present we have in India but little demand for the bark of our forest trees.

The State of Nebraska has taken up the subject of tree-planting in a manner highly creditable to such a small State. During the year 1877 the writer thinks twenty-five millions of trees (other than fruit trees) have been planted. The population of this little State was in 1860 only 28,651; in 1870 it was 122,993 and now is over 300,000.

There appear to be no natural forests, as mention is made of the "treeless plains" of the West. The State has not long been admitted to the Union. They have a regular system of giving grants of land for timber growing along with each homestead taken; the terms are very favorable, and the consequence is that they are largely availed of.

Dr. Croumbie Brown continues his abstract of the opinions of the Continental foresters as to the combination of the in-door part of forest technical education with Universities instead of having it in separate schools. The great majority were in favor of the former; but it seems not to be perceived by the advocates of the Edinburgh arboretum scheme, that this

has nothing whatever to do with the question; and that the sole objection to the Edinburgh scheme is, that *forestry* could not be taught. The students would have to go and see real forests in France or Germany, and would need to learn the system and the language before they could understand it, unless Professors expressly trained in those forests were appointed to the school, and afterwards sent with the pupils to the spot. No one doubts that Mathematics, Chemistry, Botany and other fundamental sciences could be taught at an University as well as at a separate school; the arguments of the minority in favor of schools are altogether special. When Continental foresters wish to see the in-door part of forestry studied at Universities, they know perfectly well that Railway communication places the best forests within easy reach, and there is no difficulty with *them* as with us about a foreign language and a foreign system.

In the MAY number notice is given of Mr. Hutchison's Reports on the Forestry of Scotland. The report is contained in seven pages further on. It is understood, however, that a more enlarged work is contemplated, the existing report being in fact a resumé prepared within compulsory limits for the Congress to be held in connection with the great Paris Exhibition.

Notice is also taken of the *Catalpa* tree, about which we also have an article in our present number.

We must quote the following remarks on *Sequioia* (*Wellingtonia gigantea*), as the ideas commonly entertained regarding this tree are various and generally exaggerated.

"We are indebted to our esteemed contributor and correspondent, Sir Robert Christison, Bart., for the following valuable and interesting notice of the world-wide famous Giant Trees of California. Sir Robert writes: "In various quarters, and once lately in the *Journal of Forestry*,* imperfect (and sometimes garbled) accounts have appeared regarding the Great Mammoth Vale Trees of California. Recollecting minutely the particulars of an *original* account of them in 1854, I have hunted it out, and now send you a copy. The account

* *Journal of Forestry*, Vol. i., p. 779.

is very particular, and bears the mark of careful observation and accuracy.

"The big trees (for there are 131 of them over ten feet of diameter, standing on the limits of a few acres) stand in Mammoth Tree Valley, about thirty miles north of Sonora, in Calaveras County. The Mammoth tree, which has been felled, was bored down with long augers, and took 4 men 22 days to get it down. The stump stands about 6 feet above the level of the ground, and its top has been made level and smooth, which required 16 days' work. I measured it from the inside of the bark, and it measured 25 feet. It is perfectly sound and clear to the heart. The bark, to the height of 52 feet, has been taken from the trunk in sections, and sent to the Fair at New York.*

"If the top half of the tree [its upper half as it lies] were taken off, so as to make a level surface, a stage-coach with four horses might be driven on it, from the butt towards the tip, a distance of 166 feet, it being at this length 10 feet in diameter. At the length of 280 feet it is 4 feet in diameter. At this point it was broken off in falling, and the top was broken into fragments so fine that I could not measure them; but its height had been taken before it was felled, and set down at 300 feet. It is called *Arbor vitæ*, but it is not fully decided to what variety it belongs. It is a little curious that no other trees of the same kind can be found less than 7 feet in diameter, and this tree is estimated by a scientific gentleman from San Francisco to be 3,100 years old.

"There are many others still standing of the same kind which are monsters; some even larger than this, but not sound. One, called Uncle Tom's Cabin, has a more commodious room in it than many miners' cabins. There are some large ones blown down, and one I must not fail to describe. It was evidently decayed before it fell, and in its fall broke off 60 feet from the roots. This part is hollow, and I cannot give you a better idea of its size than by telling you that I rode my horse through it from

* I have no doubt this was the Wellingtonia bark which was built up in the Crystal Palace at Sydenham, and was burnt in the great fire there. I measured the interior and found it 25 feet in diameter.—R. C.

end to end. At the end where it is broken off the shell is very thin, and as I sat on the horse I could not reach my hand to the inner surface over my head. But halfway through the shell was so much as three feet over my head, and more than that under the horse's feet, and here it was necessary to lean forward. But this is not the largest. There is another one blown down, which measures 110 feet in circumference and 410 feet in length. This too is hollow, and if the hollow were enlarged a little it would make a very good ropewalk."

[*Mr. Walter Hitchcock*, as quoted by Mr. John Russell Bartlett in "Personal Narrative of Explorations and Incidents in Texas, New Mexico, California, &c., connected with the United States and Mexican Boundary Commission in 1850-51-52 and 53." London, 1854, ii., 22, Note.]

We next commend to notice a careful paper,—Mr. Alfred Burrow's papers always are good—about grasses and permanent pasture. Of course our Indian grasses are different altogether, but a paper of this kind is exceedingly instructive, and very soon the question of pasture lands will come upon us in the plains of North India, for the "common" or waste land is now rapidly becoming a thing of the past, as people will soon have to look elsewhere than to a kind nature and a paternal government, to find grazing for them on large areas of waste land, which once indeed lay idle save for the grazing, but now are daily coming into demand for forest crops and timber plantations.

The continuation of the "Technics of Forestry" this month contains some remarks (with sketches) on felling trees, which are in every way applicable to this country and should be read.

Then "comes my dream again,"—the British School of Forestry, this time with a tremendous scheme of studies which can only be described by the word (for which we crave pardon) "jumble."

Throughout the whole course there is *no Forest work of any kind!* In summer or autumn months there are what are called 'tours of observation' to be made with *or without* a teacher. That is all. No work in surveying for forest purposes; no practical discrimination of the area of forest according to

soil, growth, conditions; no valuation survey; no practical *management* work, nor study of existing working plans on the spot, (the student being required to fill up blank forms, with figures obtained by his own calculations and then compare them with the existing sanctioned plans) not a word about forest rights, their settlement and extinction, the regulation of their exercise, nothing about demarcation of forest, and the determination of the limits of areas having a specially protective character in mountain ranges, &c. No doubt all this is usefully replaced by studies in Sylviculture as applied in Belgium "to utilize waste lands," and in India "to secure desiderated good" to a course in conveyancing (!) combined and tempered with doses of Political Economy and Bandaging and Surgical appliances.*

But the whole scheme shows such a perfect want of method, such a hopeless confusion of mind as to the parts into which the study of forestry naturally divides itself, such inability to fix the relative places of direct forest teaching, and of the sciences which are ancillary to it, that further criticism would be mere waste of time.

There is in this number an interesting paper on the introduction of foreign trees into Great Britain, and a notice of the "Rain Tree." The Editors appear not to have seen Professor Thistleton Dyer's note on the subject.

Another report also appears on Canada Forests; it is perhaps premature to speak positively on the subject, as the American reports are all preliminary: but we cannot help feeling in regard to all those reports that they are too much from the nurseryman and park tree planters' point of view. We hear nothing about the demarcation of large well-situated blocks of forest, either of forest that still remains intact or of forest that has been abusively treated and must now be restored: we hear nothing of placing those blocks under systematic treatment determining the real annual yield and organizing a service to look after their management. All these things seem not to be noticed in the hurry of issuing circulars to nurserymen, charcoal burners, and engine drivers, who no doubt will give many

* We by no means depreciate this in itself, it is a most useful study.

valuable facts as to the requirements of the country in regard to wood: but that should be only supplementary to the main work we have indicated, and which is apparently taken little or no notice of in the American reports.

In the JUNE number, the Editor gives a resumé of the Reboisement work done in France. Since the forest law of 1860, 119,000 acres has been either planted or turfed (these are all lands on mountain slopes and taken on hand, for protective purposes). The cost has been £ 206,805, of which rather more than half was contributed by the State. Then there are the works of reboisement to protect against inundations, of which 72,000 acres have been completed at a cost of £304,000.

This number contains a number of articles which are of no interest to foresters in this country, but we are glad to see a carefully-compiled table of prices of timber, which if kept up will be very valuable.

The following extract regarding "Mesquit Beans" (is this the species *(Prosopis pubescens)* that has been sent?) will be found interesting:—

"The author of the book named 'Two Thousand Miles on Horseback in Texas,' tells a wonderful story about the subterranean forests which he observed on the prairies lying near the River Conch in the western part of the State. 'Riding over these vast prairies,' thus the story runs, 'though you will see no trees, yet you will often see a little tender switch of the *mesquite*, shooting a few feet above the ground. Now stop at one of these and strike at its root with a pickaxe—you will expect nothing but tender fibrous roots; but instead of these the pick comes in contact with a heavy solid body. Surprised, you remove the covering of earth, and you find a living log as thick as a man's leg, extending you know not how far. Exploring further around the same shoot, you find many logs of the same size, and an infinite number of branches extending from them. Thus each little twig yields you from a quarter to a half cord of fuel wood, not equalled for that purpose by any other wood within my knowledge. Thus these treeless plains are filled with fuel, almost equal in supply to the heaviest forests. These shoots do not increase in size, but

after attaining a certain dimension, too small to be dreaded by an urchin, they either stand to that, or die and give their place to others. The branches of the large roots left in the ground speedily supply the loss by other roots as large as those away.' "

Grevillea.

In "Grevillea" for March 1878, p. 117, is given a list of Fungi found on forest trees in India. Many of these were species of *Peridermium;* and have been described in the "Forester" at page 91 of Vol. III. Besides these, however, a number of other species were collected by Mr. Gamble near Simla, and by Mr. Baden-Powell near Dalhousie, and sent to Dr. Cooke. A short account of these will be usefully recorded in our columns.

1. The Barberries about Simla, (*B. aristata* and *B. lyceum,*) were last year found to have their leaves often attacked by a scarlet or orange-coloured fungus. This proved to be *Æcidium berberidis,* Pers., the curious fungus, which, according to late investigations, can only be produced by the assistance of other flaws which are commonly known as 'blight' and which attack cereal crops. Mathieu says: "Its spores can only germinate on the leaves and stalks of grasses, and especially cultivated kinds, and germinating they give rise to new forms known by the name of blight, *viz.*, 1st, *Uredo linearis,* Pers., of which many generations successively appear during the whole summer; and 2nd, *Puccinia graminis,* Pers., which succeeds the *Uredo,* and whose single generation produces in its turn spores which, dispersed in spring, germinate on the young leaves of the Barberry and then produce the form known as '*Æcidium Berberidis.*' "

2. At Simla and Dalhousie the Shrubby Willow (*Salix elegans,* Wall.,) which is so common, was found in many places to have its branches and leaves attacked by an orange-yellow powdery fungus. This has been identified as *Lecythea salicina,* Lev.

3. The Poplars about Simla, (*Populus ciliata,* Wall.,) were attacked by a curious fungus, which appeared like a white

chalky powder on the leaves. This proved to be *Erysiphe Martii*, Lev.

4. The leaves of Roses (*Rosa macrophylla*, Wall.,) about Dalhousie were attacked by a yellow fungus somewhat like *Æcidium*; the same is very common this year both on *Rosa macrophylla* and *R. moschata*: it is said to be *Phragmidium mucronatum*, Fr.

5. A fungus brought from the Chor, from 11,000 ft. altitude, growing on leaves of *Prunus padus*, was *Polystigma fulvum*, D. C.

6. One from the same place, on leaves of *Pyrusursina*, was determined to be a species of *Erineum*.

A number of new kinds have been collected this year and are being sent to Dr. Cooke; some of them may prove to be injurious as the *Peridermia* undoubtedly are. For instance, *P. Thomsoni*, which has been extremely common this year on *Abies Smithiana*, appearing like bright orange tassels at the ends of the small branches, attacks and kills not only the freshly-formed leaf buds, but also, in many cases, the whole of the small branch on which it grew, and which dies down to the large branch or stem. The collection of these specimens may be the beginning of a knowledge of one branch of the diseases of forest trees, but it is the other branch, *viz.*, the investigation of destructive insects, which would be far more interesting and more useful, did we know anything about it.

A beginning was made by Mr. B. Thompson in 1868, but since then nothing new has been recorded.

A Catalogue of the Forest Trees of the United States, which usually attain a height of sixteen feet or more, illustrating the collection sent to the Centennial Exhibition at Philadelphia, 1876.

Of the 38 pages which form this little book, no less than eight are devoted to coniferous trees, and three to cupuliferæ—a pretty good evidence that those two families play the greatest and most important part in the forest vegetation of the United States of America. Dr. Vasey's account is scarcely a list, however, of American forest trees; as it merely was published

as a catalogue to illustrate the collection of wood specimens exhibited at the Philadelphia Exhibition in 1876. The collection then exhibited had been got together by the united labours of a number of collectors in different parts, who cut and forwarded specimens to a central depôt in Washington, much in the same way as was done in this country for the collections sent to the Exhibition at Paris. In Washington, as Dr. Vasey describes it, most of the logs were cut into two-foot lengths, and there again sawn down the middle and placed on the cut surface. Thus they could be exhibited, one half to show the appearance of the back, the other half that of the wood cut on a radial section, the section which shows the mottlings and grain of the wood to the best advantage. In the case of the large pieces of coniferous wood obtained from the giants of the Californian Coast, large wedge-shaped sections were exhibited, the preparation of which cost a large amount of toil and expense. The number of species described reaches 419; though wood specimens of all were not procurable for exhibition. Dr. Vasey says that "this catalogue presents, with great accuracy, our present knowledge of the trees of the United States." The number of Indian trees of large size only which have been got together for exhibition this year far exceed the number in America, and had we to count all that are known from the different Forest Floras, we should have a number of species of quite four or five times the number given in the American list. And yet in varied climate, British India and the United States may well be compared, for like the Indian Flora which has every range from the tropical forest of Malabar and Tenasserim to the stunted growth of Laherel and Spiti—from the desert regions of Sindh and Rajpootana to the fertile plains of Bengal and Pegu—that of the United States ranges from the hot swamps of Florida to the cold mountain ranges of Columbia and Oregon; and from the cultivated valleys of New England to the prairies of Texas and New Mexico. Dr. Vasey gives little or no descriptive account of the different timbers, his statements being mostly limited to a brief statement of the size and appearance of the tree and the colour and hardness of the wood. Among the specimens described, we

recognize numerous conifers which we have seen introduced into Britain and many others of which we have read. Perhaps the most valuable of the coniferous trees described is the *Juniperus Virginiana* or Red Cedar, of which the variety *Bermudiana*, found in the forests of Florida, gives the cedar, of which lead pencils are made. The 'Arbor Vitae,' (*Thuja gigantea*,) of Oregon has a soft, smooth, and durable timber used for building, and is said occasionally to reach 200 feet in height with a diameter of 10 to 15 feet. The *Pinus strobus*, chiefly known in Europe as the 'Weymouth Pine,' a tree nearly resembling our Indian *Pinus excelsa*, is said to be very valuable on account of its wood, and to be 'the source of much of the timber brought from the Northern States.' The Walnuts (*Juglans nigra* and *cinerea*) and the Hickories (*Caryo* sp. sp.) have all valuable woods as might be expected from members of the Walnut family. The American Olive (*Olea americana*) is said to have a wood impossible to split, and hence to be popularly called 'Devilwood.' Much has lately been heard of the *Catalpa* (*C. bignonioides*,) the wood of which is said to be light, of a fine texture, polishing well, and very durable. We are rather surprised to learn from page 15, the description of the Mangrove tree, that it forms *impenetrable thickets like the Banyan tree of India* : but it was probably a slip. The Mesquit Bean (*Prosopis glandulosa*) and Screw Bean (*P. pubescens*) have lately been much grown in India. The former is said to have a hard, dark-brown wood resembling mahogany, while both have pods which are useful as fodder. Of the numerous other trees mentioned little need be said, except that among them are many of great interest. The catalogue should be useful as a kind of index to the popular names of American trees, and for giving many hints as to what trees would be most useful for introduction, either for use or for ornament.

III NOTES AND QUERIES.

Preparation of Bamboo Fibre for Paper-Making.

TO THE EDITOR OF THE "INDIAN FORESTER."

DEAR SIR,—I was somewhat astonished to see in your last issue a letter from Mr. Routledge, the well known pioneer of Bamboo Paper, criticising a report of mine on the preparation of Bamboo Fibre, which was printed in your issue of July 1877. I was as much astonished as I should be if a man told me he had used a steam hammer to crush a fly. Mr. Routledge has evidently over-estimated the importance of the Moharli experiment, and misunderstood its object, which I will now, with your permission, proceed to explain to him.

We had all of us heard and read a good deal about the suitability of Bamboo Fibre for the manufacture of paper; we at once recognised the superiority of this scheme over that other one of mingling the cast-off rags of ill-clad natives with old and equally useless cutcherry records. We were assured that we could prepare the fibre with comparative ease out in the jungles, and that the chief point was to choose the young shoots at the proper time, neither too young, nor too old. So we determined to prepare some Bamboo Fibre. We limited ourselves to this, for with our accustomed modesty we came to the conclusion that we scarcely knew enough about it to turn out actual paper. Starting then with the sole object of extracting fibre from Bamboos, three courses were open to us; we could have set a lot of men to beat out the young stems with sticks: this is a method used in jails for aloe and other fibres, and is excellent in results, if slow in procedure. This method would have taken too long, so we had to give it up; or we could have adopted the plan used by the Brinjaras of Central India in the preparation of fibre from the root of *Butea frondosa*; they chew it in their mouths, and the result is a beautiful fibre and pearly white teeth. The population of the

Moharli forest was not at that time sufficiently dense, nor were their teeth sufficiently good to warrant our adopting this method, and it had to be given up with reluctance. The third course was the one we eventually took. It is a great country for sugar cultivation, and at certain times of the year sugar-mills are at a discount. We had previously noticed the resemblance between the crushed stems of the sugarcane and the specimens of rolled Bamboo sent by Mr. Routledge for our guidance. So we set up our sugar mill, and went to work in the most approved method of sugarcane crushers; the only difference was that we threw away the juice, and boiled the stems, which, of course, is just the reverse of what the sugar men do, and our fame was great in the land. People came from far and near to see what the Sahibs were up to, and wondered whether it was true that the Bamboos from 350 square miles of forest were really going to be manufactured into paper. But, as already explained, that was not our object; otherwise the 25 bags of fibre produced would not have been consigned to oblivion, but, in part at least, would have been sent to England for Mr. Routledge to convert into paper.

The Moharli experiment proved conclusively that it would not pay to utilize the country sugar-mill for the manufacture of Bamboo Fibre; it did not prove, and did not attempt to prove, that with an improved rolling and crushing mill (with, let us hope, a stronger shaft than they seem to have had in Burma, and other requisite appliances,) the enormous and increasing quantity of spare Bamboos in that forest could not be utilized for the manufacture of paper stock. The fatal drawback will always be found in the unhealthy character of the Chanda jungles in October and November, the time proposed by Mr. Routledge for cutting the young Bamboo shoots.

It seems to me useless to answer Mr. Routledge's criticisms, though it would be easy to do so; he has evidently not understood the object of the experiment which, as far as it went and as far as it intended to go, was successful.

I remain, DEAR SIR,

Yours truly,

A. SMYTHIES.

Pithecolobium Saman.

Extract from the Proceedings of the Government of India in the Department of Revenue, Agriculture and Commerce.

(*Report by Dr.* G. Birdwood, *dated* 20*th May* 1878.)

The *Pithecolobium Saman*, under its more familiar names of *Inga* and *Mimosa*, will be recognized by all Anglo-Indians as a congener of *Inga bigemina*, a native of India, and *Inga dulcis* (*Vilayati chintz*), and *Inga hæmatoxylon*, the Logwood tree, both of which have become thoroughly naturalized in India.

The *Pithecolobium Saman* is evidently an invaluable economic tree, and is likely to flourish luxuriantly everywhere above the Western Ghauts [*Balaghát* and *Mawuls* of the Deccan]; on the Coromandel Coast and across Central India from the mouth of the Nerbudda to the deltas of the Mahanuddy and Godavari; in the Lower and North-West Provinces, and westward of the latter along the southern slopes of the Himalayas to the confines of Afghanistan. It is less likely to flourish on the table land of Mysore, in the Bhima and Sina Tarai, in Rajpootana and Scinde; although it might be tried on the banks of the Indus. The seeds should be sent by the next mail so as to reach Bombay just after the burst of the monsoon.

Distribution of Timber Specimens.

Resolution of the Government of India.—In the Circular from this Department, No. 8F., dated the 19th January last, enquiry was made from the local Governments and Administrations under the Government of India, as well as from the Governments of Madras and Bombay, whether they desired that collections of correctly-named specimens made from the pieces which had been sent to the Inspector-General of Forests for the Paris Exhibition should be deposited in the offices of the Conservators of Forests, and suggesting that Conservators might be permitted to communicate their wishes on the subject direct to the Inspector-General of Forests.

2. The Inspector-General of Forests reports that in reply to that Circular letters were received from the Conservators in the Madras Presidency, the Northern and Southern Divisions of the Bombay Presidency, in Bengal, the Central Provinces and British Burmah, and from the Deputy Conservators in Assam and Berar, asking for such collections for their office museums. The Conservators in Oudh and Sindh, in stating that their office accommodation was not sufficiently large to hold such a collection, asked that the specimens might be sent and deposited in the museum at Lucknow, and the Frere Hall at Kurrachee, respectively, until such time as sufficient accommodation became available; the Government of the Punjab desired that the collection for that province should be sent to the Lahore museum; the Conservator of Forests in the North-Western Provinces represented that his office did not possess sufficient accommodation, and asked that a collection might be deposited at Dehra Doon at the proposed Forest School. These suggestions were acted upon, and collections were prepared and despatched accordingly.

3. The Conservator of Forests in Mysore proposed to keep the collection packed up until such time as he could find space for it in his office. But as the retention of such specimens packed up in boxes at Bangalore would result in their partial destruction, it was decided not to send any collection to Mysore.

4. The whole of the specimens sent were marked, in the manner described at pages 4 and 5 of the Catalogue of the forest collections sent to the Paris Exhibition of 1878, with a letter and serial number; and in most cases the systematic name was also stamped upon the piece. The Inspector-General of Forests reports that any alteration which may hereafter be made in the systematic name of any specimen will be recorded in a manual of the structure, qualities, and distribution of Indian timbers, now under preparation.

5. The collections were despatched from Calcutta early in April, and the numbers sent to the different provinces were as follows :—

Bengal	877	pieces.
Punjab	860	„
Madras	783	„
Assam	780	„
Berar	675	„
Central Provinces	574	„
British Burma—		
Rangoon	680	„
Moulmein	646	„
Oudh	569	„
Bombay—		
Southern Division	594	„
Sindh	554	„
Northern Division	493	„

6. In distributing the collections, it was arranged that, as far as possible, each province should have specimens of its own contributions, as well as of those from the neighbouring provinces.

7. In addition to these collections, 517 polished specimens, with the systematic names painted on them, were sent to Dehra Doon for the Forest School, and a complete set of all pieces now in use for the preparation of the manual adverted to, will also be sent to Dehra Doon, when no longer required for that purpose.

8. In the preparation of these collections, as well as of those sent to the Paris Exhibition, the Indian Museum in London, the Museum of Economic Botany at the Royal Gardens, Kew, and to other institutions in Europe and North America, the Inspector-General of Forests received valuable assistance from the authorities of the Government Dockyard at Kidderpore, and the Agents of the British India Steam Navigation Company. As an acknowledgment of this assistance, small collections of 66 and 70 kinds, respectively, of carefully-prepared pieces of the chief Indian timbers, were sent to the Superintendent of Marine, Eastern Division, and to Messrs. Mackinnon, Mackenzie and Company. In addition to these, 100 pieces, representing the principal timbers of Bengal, Assam, and Burma, were deposited at the Economic Museum of Calcutta, to which institution was also sent a collection of

fibres and other forest produce. A small collection of timbers has been deposited at the office of the Inspector-General of Forests in Calcutta.

9. The collections sent to Conservators' offices and to the Forest School at Dehra Doon are chiefly intended to facilitate the study by Forest officers of the structure and qualities of Indian timbers. The Governor-General in Council trusts that these collections will be systematically arranged and carefully preserved. They should be unpacked on receipt, and due care and attention should be devoted to them so as to maintain them in good order.

10. The acknowledgments of the Government of India are due to the Inspector-General of Forests, and to those associated with him in the collection and distribution of these forest specimens, for the care and completeness with which the work has been carried out.

A Plea for Sal.

TO THE EDITOR OF THE "INDIAN FORESTER."

DEAR SIR,—I see from the March number of the report of the Proceedings of the Asiatic Society of Bengal, that in the list of woods prepared for exhibition in Paris and elsewhere, Sâl appears in the second class amongst "woods mostly durable, many very handsome, but all exceedingly hard and heavy, difficult to work, and expensive in carriage. The number of the woods which may be placed under this class is very large, and if there were a demand for them, their number might be increased indefinitely, but there is no demand, and it is not likely to spring up."

In the Rurki Civil Engineering Treatise, in the chapter on Timber, where there is a description of 126 of the best known Indian species of timber trees, Sâl is described as follows:—

"The Sâl furnishes the best and the most extensively-used timber in Northern India, and is unquestionably the most useful known Indian timber for engineering purposes."

Sâl is also not a very heavy wood; its specific gravity is given in Balfour's Indian "Timber Trees," page 88, amongst a

number of Cuttack timbers as 1,000, or the same as that of water, and well-seasoned Sâl wood frequently floats in water.

I tried an experiment with seasoned and partly seasoned Sâl scantling, 3″×3″, and found that the better-seasoned wood floated and that of six pieces taken up at hazard four floated and two sunk.

As we are accustomed in Assam and Bengal to regard Sâl as the equivalent of the European Oak, I wish to raise a plea for its position in the first class of Indian trees, and as above Sissu and Blackwood, both of which are carpenters' rather than builders' timber, and in France would be classed as 'bois de travail,' as opposed to 'bois de service.'

In Lower Assam the trade in Sâl timber has been established for years, and exports to places in Lower Bengal have been very large. A few years ago, over 300,000 logs were exported annually from the Goalpara district alone, and last year, in spite of the denudation of the forests of mature timber, over 225,000 logs were exported. The quality is, however, very inferior now-a-days, nearly every log containing sapwood.

Most of the timber exported used to be in the form of *dhums*, short logs 6 to 7 feet in length, and formerly exceeding 4½ feet in girth, and entirely heartwood; but now frequently of a less girth than 3 feet, and containing a large quantity of sapwood, which in Sâl timber is very worthless.

Dhums are sawn up for planks for boat-building, and in consequence of the inferior quality, boats formerly lasting 20 to 30 years now only last 2 or 3 years without repairs.

Hundreds of these boats, which are built with smooth sides, not in clinker fashion, pass every day up and down the Brahmaputra River, carrying down country produce, jute, cotton, mustard seed, and timber, and bringing up to Assam rice, salt, lime, and manufactured goods. They have frequently a burden of from 700 to 1,000 maunds. Sâl timber, of a girth too small for boat-building, is cut into rounded house-posts, which are classed according to their length and quality, and as timber suitable for *dhums* becomes scarce, the export of these house-posts increases, not a tree, in the immense private forests in the district, of a girth exceeding 2′ 6″ being spared. As to the

value of Sâl timber, in 1876 Rs. 19 a pair was paid for one lot of about one hundred *dhums* from the Garo hills, and I have heard that as much as Rs. 40 a pair was paid last year for one lot.

The average girth of the best *dhums* now rarely exceeds four feet, and so expensive is good Sâl timber, that teak posts and scantling costing Rs. 2-12 per cubic foot landed at Dhubri are being imported from Calcutta. The other timbers used for boat-building are Sama, (*Artocarpus chaplasha*), and Titta Sappa (*Michelia champaca*), both of which are reckoned as equal to Sâl, but they are very scarce, and the quantity of timber exported is inconsiderable.

Jarul, or Ajhar, ('*Largerstœmia regina*,') spoken of in the Rurki Treatise, as reckoned in Burma to be second to teak, and in great request for all purposes, is also brought to market. It is an excellent wood when sawn up into scantling, both under water and for interior work, but being very liable to split when exposed to sun. It only sells at Rs. 5 to 8 a pair of *dhums*, although the girth of those brought to the market is from four to eight feet.

Sissu wood is as yet unknown in the timber markets of the district, although there are forests of Sissu in the Duars; and Sâl is even used for cart wheels, for which purpose it is inferior to Sissu. With these facts before them, I leave your readers to judge whether Sâl should not rank amongst the very first of Indian timbers.

W. R. F.

Seed of New Trees from Queensland.

Mr. Hill, the Superintendent of the Botanic Gardens at Brisbane, Queensland, has lately sent seed of a new species of *Eucalyptus* not yet named, recently discovered in tropical Queensland. He says it is most likely to become of considerable commercial value, as, in addition to the timber which is good and durable, the leaves upon distillation yield a fragrant verbena-scented essential oil, excellent for perfumery. It appears that the quantity of oil is also very large, Mr. Starger, the Government Chemist at Brisbane, having obtained

3 lbs. of oil from 112 lbs. of leaves. Mr. Hill at the same time sent seed of *Araucaria Bidwilli*, a noble tree inhabiting the scrubs between the Brisbane and Burnett Rivers. It grows thickly over a portion of country in the 27th parallel in extent about thirty miles long by twelve broad, and has a singular appearance, the trunk being quite straight, the bark thick and smooth, and the branches produced in whorls of six, seven, or eight. These branches are horizontal, inflexed, and ascending at the extremities. From the style of growth, singular foliage, and peculiar fresh colour when surrounded with trees of a different habit and greyish tint, it produces a fine effect from the striking contrast presented by its rigid growth and fresh green lance-shaped leaves. The timber is also not only very strong and durable, but it is full of beautiful veins, and capable of being polished and worked with the greatest facility. The cones produced on the extreme upper branches are large, measuring 10 to 12 inches in length and 10 inches in diameter. To ensure success the seeds of *Araucaria* should be sown with the small end downwards. These seeds are now being tried in different localities in the Punjab.

The Baobab Tree in South Punjab.

TO THE EDITOR OF THE "INDIAN FORESTER."

DEAR SIR,—Mr. Wilson, the Settlement Officer of Gurgaon, has permitted me to send you the following letter, showing that a specimen of the Baobab tree, (*Adansonia digitata*), exists in this province.

The tree was introduced into India from Tropical Africa (where it is indigenous) by Arab traders. Individual specimens have found their way as far north as Ajmir and the North-West Provinces. In Ajmir it is also called the "Kalp-briksh" or "Wishing tree."

It is not unfrequently that seeds of uncommon trees are transported by *fakirs*, &c. Those planted near wells, or under favorable circumstances, survive and become surrounded with popular legends and superstitions. It is not long ago that the late lamented Deputy Commissioner of Rohtak

sent me a specimen of a tree which had been raised from a single seed, brought by a *fakir*, and which had been carefully tended, and had grown into a fine tree. As the people of the district were unfamiliar with its yellow flowers and long pods, they soon told many strange stories about it. It turned out to be the 'Amultàs' (*Cassia fistula.*)

Yours sincerely,

June 26th, 1878. B. H. BADEN-POWELL.

DEAR SIR,—It may interest you to hear of a strange tree we came across the other day (if you have not heard of it before). It was pointed out to us in a field near Tilpat in this tahsil, one of the five "*pats*" or "prasthas" (प्रस्थ) of the old Pándava Princes. The people say that there is no other tree of the same kind in the whole of Hindustan, and cannot tell its specific name. They call it *kalapbirchh* (कल्पवृच) the Wishing tree, and say that some 4,000 years ago when Kairo, one of the Pand Princes, conquered the country, he gave a great feast (*jag karí*) to all the people round and planted this tree which he had brought with him as well as the *kámdhenu* (कामधेनु), the Wishing-cow. So long as the cow remained with the tree, the latter had this property that any wish formed under it was sure to be fulfilled. But now that the cow has gone back to heaven, the tree has lost its power, though it retains its former name.

I am not botanist enough to venture a guess as to what the tree is. It stands about seventy or eighty feet high, and at a height of three feet from the ground measures twenty-two feet round the trunk, which tapers slowly to the height of fifty feet, and then suddenly spreads out into a number of branches. The bark is peculiar, being indented with hollows which are said by the people to be the foot-marks of an elephant, a horse, a man, &c. I enclose one of the few leaves which had escaped the frost, and send a specimen of the fruit separately. I should like much to know what the tree is.

Yours faithfully,

G. WILSON,

A. S. O.

IN CAMP BALABGARH, DELHI, 18*th January* 1878.

Effect of Mortars on Pine Timber used in Buildings.

A communication (published in *Nature* for May 2nd, 1878) has been made to Professor Tyndall from Rome, regarding the effect of a kind of mortar on pine wood.

For many years past chestnut was the wood chiefly used in buildings at Rome, but latterly, pine brought *viâ* Venice from the Dolomite Alps has been employed. It was found that the ends of beams of this pine, when imbedded in walls, very soon decayed and gave way. This was remarkable, because in Venice itself beams of the same pine and in the same positions in the buildings had been known to last for centuries. At last, a scaffolding pole of pine was discovered; it was buried four feet in the ground, and round the base lay a heap of "Pozzolana" mortar. It was found that the buried part of the pole was perfectly sound, while the portion in contact with the mortars was completely rotten. Pozzolana mortar is a mortar in which Pozzolana, 'a volcanic earth,' is used instead of sand.

Development of the Colors of Wood.

Sir,—Can any of your correspondents enlighten me as to the cause of the change in color effected by steeping oak boards in lime water? The lime water is prepared as usual by pouring water on quick lime, and when the sediment has settled, carefully pouring off the clear liquid into a clean vessel; a piece of light oak wood, floated in this, or rubbed with it repeatedly, becomes a good brown colour, and, when finished with French polish, has a most beautiful appearance of old oak, the "grain" being brought out.

This must be due to some chemical change, as the lime water is itself clear and colorless.

While on this subject some of your readers may be interested to know that our deodar wood assumes beautiful tints of brown and purple (the grain being prominently brought out) when treated with diluted sulphuric acid, it is desirable

that the wood should be planed and finished and perfectly clean. Pure acid should be obtained, and diluted with three times, four times (or more) the quantity of water, testing the result of the different strengths, on a piece of clean board, before applying it to the object in hand. When the right shade has been obtained, the surface may be well washed with water. The texture of the wood is not injured. I have a case of deodar stained in this way and French polished (all other varnishes for furniture are simply abominable), and it is of the most pleasing rose-wood color.

J. K.

The Forests of Cyprus.

THE central part of the island is occupied by a chain of volcanic mountains which contain a certain proportion of forest, whose area may be estimated at 200,000 hectares, half of which is high forest and the remainder scrub jungle and old forest in a ruined condition.

The Island of Cyprus, one of the most fertile of the islands composing the Greek Archipelago, was, before its conquest by Turkey, remarkable for its richness and for the density of its population. We know that in ancient times it must have been admirably endowed with forest vegetation since the powerful navy of the Phœnicians drew from it the greater part of the timber it required for the construction of its innumerable ships. It was also equally renowned for the superior quality of the resin it produced.

But now, oak is no longer found, and all that remains of the old forests is composed of Aleppo Pines (*Pinus halepensis*), a few 'laricio' in blocks, which, however, are but thinly peopled.

The impoverishment of these forests does not date from a very distant period, and it may be admitted that in the last twenty years the wooded area has decreased by a third, and the amount of material by half, while number of trees may be seen lying on the ground in the place where they were felled.

With the object of preventing the increase of denudation the Turkish Government has forbidden the export of timber, and the fellings have been reduced to the quantity necessary for local consumption in building and manufacturing timber and firewood.

Now this last is very abundantly used; ten factories alone use up for their engines from 15 to 20,000 stires; and the cutting of this amount is ruinous to the forests, through the firewood being chiefly cut in the portions of the fôrests nearest to the mills.

The manufacture of tar, of which about 2,300 hundredweight are yearly produced, does even still more damage to the forests. It has been proposed to put up to auction the right of extracting resin in the pine forests of Cyprus which might produce 40 to 50,000 hundred weights of resin, but without result.

Attempts have been made to reboise the low and unhealthy parts of the island with Eucalyptus, but we have not yet heard with what result.

Translation from the '*Forêts de l' Empire Ottomane*' in the '*Révue des Eaux et Forêts*' for November 1877, p. 471.

Species of Prosopis.

On different occasions, during the last two years' consignment *of two or three species* of 'Prosopis', called 'Mesquit' Bean, have been sent out to India for experiment by the Secretary of State. One species, the *P. pubescens*, has a small pod extremely twisted in a peculiar way; another, *P. glandulosa*, has a straight pod, and both species are used in America as fodder for cattle and horses. The seeds received were distributed to officers in different provinces for sowing and trial, and among the reports received about them is the following from the Superintendent of the Horticultural Garden, Lucknow, who says:—

The parcel of seed of Mesquit Bean (*Prosopis pubescens*), dated May 29th, was found, when opened, to contain a large

number of seeds injured and destroyed by insects. These were picked out and thrown away, and the remaining good seeds were sown in light soil in pots, July 23rd, 1877.

In from three to four days most of the seeds germinated, and when about two inches high were transplanted singly into small pots. They maintained a slow steady growth till the middle of October, at which time they were four to six inches high, when the cold weather growth ceased, and the plants shed their leaves. Towards the end of February, they again came into leaf, as the temperature increased, and are now making new growth. I must not omit to state that the plants were constantly kept either in the shade of trees or a chick house, so that their ability to stand frost has not been tested. There is, however, I consider, every probability of the plant being found to thrive in this part of India, although a climate with a higher winter temperature would probably be more suited to it.

At the same time as the above, a small sowing was made in a bed shaded by mango trees. This also germinated well; the plants made more progress than those in pots, which is accounted for by their receiving no check through transplanting. A second sowing was made in October 1877, also in pots; the seeds did not germinate so quickly as in the previous sowings, but still quite satisfactorily, and a good number of plants have been raised, which are now about two inches high.

The number of plants now in stock are :—

1st Sowing in pots	...	... 1,000
1st Sowing in bed	...	... 180
2nd Sowing in pots	...	... 490
	Total	... 1,670

Monsieur Bert's Visit to India.

Our readers will be sorry to hear that the French Officer, M. Bert, who has been for a short time in India on his way to examine the forests of Cochin-China, has, owing to slight illness, decided not to continue his travels in India at present, but to proceed to Java and Siam, and if possible, during next cold weather, to visit the forests of British Burma. It is much to be regretted that he arrived at so unfavorable a season in India, as beyond portions of the Darjeeling forests and the Dehra Doon he has been able to see very little of our forests and systems of management.

IV. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA—

The 21st May 1878.—No. 531F.—*Mr. W. H. Reynolds*, Assistant Conservator of Forests of the 1st Grade, attached to the Forest Survey Branch, is granted privilege leave of absence for three months, with effect from the 15th instant, or any subsequent date on which he may avail himself of it.

No. 533F.—The Governor-General in Council has been pleased to appoint *Mr. G. F. Taylor*, Assistant Patrol in the Inland Customs Department, to officiate on probation as a Sub-Assistant Conservator of Forests, with effect from the 25th April 1878, the date on which he joined his appointment.

Mr. Taylor is posted to the Central Provinces.

No. 536F.—The Governor-General in Council has been pleased to appoint *Mr. J. C. Murray*, an Assistant Surveyor of the 4th Grade in the Topographical Survey Department, to officiate on probation as a Sub-Assistant Conservator of Forests, with effect from the 25th April 1878, the date on which he joined his appointment.

Mr. Murray is posted to the Forest Survey Branch.

The 1st June 1878.—No. 562F.—*Mr. J. Adamson*, Deputy Conservator of Forests of the 3rd Grade in British Burma, availed himself of the subsidiary leave granted to him in Notification No. 351F, dated the 14th March last, on the 26th April 1878, and, in addition to the thirty days allowed him in that notification, is granted an extension of four days' leave, *viz.*, to the 29th May 1878.

The 3rd June 1878.—No. 567F.—The Governor-General in Council has been pleased to appoint *Mr. B. A. Rebsch* to officiate on probation as a Sub-Assistant

Conservator of Forests, with effect from the 11th May 1878, the date on which he joined his appointment.

Mr. Rebsch is posted to Oudh.

The 21st June 1878.—No. 623F.—The Governor-General in Council is pleased to make the following promotions in the Forest Department of British Burma with effect from the 26th April 1878 :—

Mr. J. W. Oliver, Assistant Conservator of Forests of the 2nd Grade, and officiating as an Assistant Conservator of the 1st Grade, to officiate as a Deputy Conservator of Forests of the 3rd Grade.

Mr. J. Nisbett, Assistant Conservator of Forests of the 2nd Grade, to officiate as an Assistant Conservator of Forests of the 1st Grade.

2.—CALCUTTA GAZETTE—

The 13th June 1878.—*Mr. J. C. McDonell*, Deputy Conservator of Forests, Darjeeling Division, resumed charge of his duties on the forenoon of the 19th ultimo on his return from the leave granted to him under orders, dated the 16th idem.

3.—NORTH-WESTERN PROVINCES GAZETTE—

The 30th May 1878—No. 114A.—*Mr. S. E. Wilmot*, Assistant Conservator of Forests, 2nd Grade, Bahraich and Gonda Division, three months' privilege leave from 15th June or subsequent date.

The 7th June 1878.—No. 125A.—*Mr. E. P. Dansey*, Officiating Assistant Conservator, 1st Grade, from the Garhwal to the Jaunsar division. He joined the latter division on the 6th May last.

The 3rd July 1878.—No. 206A.—The undermentioned officer passed in Hindustani by the lower standard on the 12th June 1878 :—

Mr. E. P. Dansey, Assistant Conservator of Forests, North-Western Provinces.

The 10th July 1878.—No. 223A.—*Mr. E. P. Dansey*, Assistant Conservator of Forests, Jaunsar division, three months' privilege leave from 1st August 1878.